U.S. Department of the Interior
Bureau of Land Management

Medford District Office
3040 Biddle Road
Medford, Oregon 97504

June 1995

U.S. Department of Agriculture
U.S. Forest Service

Rogue River National Forest
P.O. Box 520
333 West 8th Street
Medford, Oregon 97501

Siskiyou National Forest
P.O. Box 440
200 N.E. Greenfield Rd.
Grants Pass, Oregon 97526

Applegate River Watershed Assessment:

Aquatic, Wildlife, and Special Plant Habitat

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

BLM/OR/WA/PL-95/031+1792

Table of Contents

Table of Figures

Table of Tables

List of Tables

Chapter I - Executive Summary

The findings and/or suggestions from the team of resource specialists assembled to continue the assessment of the health of the Applegate River Watershed have been summarized and abbreviated for a quick overview. For a more comprehensive discussion of the methods used and the limitations of the findings, please review the main document and the appendix.

The Applegate Adaptive Management Area Ecosystem Health Assessment (**EHA**) was the first entry into a "3-ring binder" concept of analyzing the overall ecological health of the Applegate River Watershed. The primary focus of the Applegate Ecosystem Health Assessment was the long-term health of the terrestrial component of the Applegate AMA. Key issues centered around the relationship between tree mortality, fire suppression, drought and the susceptibility of trees to catastrophic effects of insects, disease and wildfire. **This assessment focuses on aquatic, wildlife and special plant species and habitat** and is the next section to be added to three ring binder. Other assessments will follow or be updated and added to the binder. Monitoring is an essential aspect of adaptive management and our binder reflects the iterative process that incorporates new information and knowledge in managing the AMA's.

This analysis concentrates on collecting and compiling existing data within the Applegate River Watershed for making sound resource management decisions. It is an analytical process, **not a decision-making process** with a proposed action requiring NEPA documentation. It is designed as a basis for developing project-specific proposals, and determining monitoring and restoration needs within the Applegate River Watershed.

The Aquatic Assessment Team recognizes that a number of perspectives expressed in this document are not necessarily shared by all members of the team. Likewise, not all recommendations can be implemented given historic budgets and future staffing levels. Integration was attempted wherever possible but could not be achieved in totality due to the limited timeframes involved and the information available. It is understood that future decisions will be made by line officers using updated information on a site-specific basis for project implementation.

The key questions addressed in this assessment are:

- **What are the Historic and Current Conditions, and Trends of the Aquatic, Wildlife, and Special Plant Habitats of the Applegate River Watershed?**

- **What are some strategies/recommendations to maintain the long-term viability of the Aquatic, Wildlife, and Special Plant Habitats of the Applegate River Watershed?**

Figure 01 - **Applegate River Watershed** in relation to the Pacific Northwest

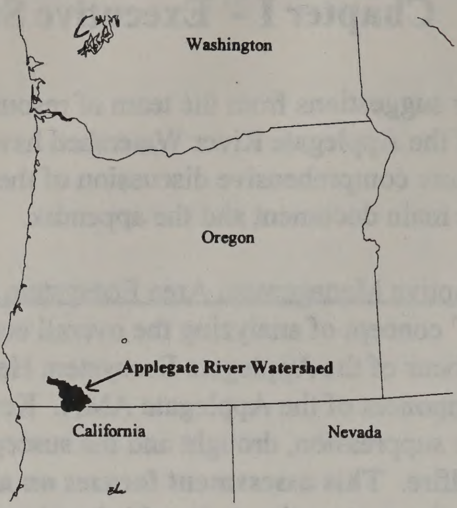


Figure 02. - **Locator Map of the Applegate River Watershed** showing geographical references and major rivers and streams.

A. Findings

Riparian Vegetation

Higher gradient streams

Logging, road building, some grazing, and fire suppression have altered natural patterns of vegetation along many of these streams.

Larger, lower gradient streams, including main stem of the Applegate River

Past and current human activity has greatly altered the vegetation in these riparian areas. Past mining activity disturbed large areas. Past logging has removed many of the larger trees. Clearing land for agriculture has removed a significant amount of vegetation in the flood zone and most of the native vegetation above the flood zone. Livestock grazing exerts a big influence on species composition in some areas. Non-native species are rapidly increasing, steadily crowding out native plant species. Along the main stem of the River below Applegate Dam, the riparian vegetation zone is narrowing as humans clear land in what was once a zone of periodic flooding. Non-native blackberries occupy much of this area.

Wetland vegetation (other than streamside)

Springs, seeps, bogs, lakeshores, fens, wet mountain slopes, and moist mountain meadows have riparian vegetation conditions that range from pristine to highly altered.

Non-Native Species And Noxious Weeds

Half of the acres in the watershed probably have one or more non-native species firmly established. Half of the remainder probably have non-natives present in the soil seedbank, waiting for the next disturbance event to increase their presence (Rolle, Seevers personal communications [1]). A large portion of lower elevation open areas in the watershed have herbaceous vegetation layers completely dominated by these species.

Non-native species invasion is the primary reason that native low-mid elevation grasslands were listed in the EHA as a community at risk of extirpation, and a major reason that moist mountain meadows and valley floor native plant communities were listed.

Yellow star thistle is the most serious noxious weed in uplands. Blackberries bushes are the most serious invader in riparian areas in the valley bottoms.

[1]. Personal communication with Wayne Rolle (RRNF Botanist) and Joan Seevers (Medford BLM District Botanist).

Rangelands

- primary and secondary rangelands (mostly moist and dry natural openings) contain a large proportion of the terrestrial biological diversity in the Applegate River Watershed, and;
- much rangeland is in unsatisfactory ecological condition.

Rare Plant Communities

The EHA, pages 32-34, lists specific rare plant communities that are considered at risk of extirpation from the watershed.

Rare Plant Species

Vascular plants

102 plant species are considered rare within the watershed. Of those, 39 are considered at high risk of extirpation from the watershed in the foreseeable future (Table 11). Of those, the EHA pages 35-36 lists the species that have the highest priority for recovery efforts.

Mosses, liverworts, lichens, and fungi

A long list of mosses, liverworts, lichens, and fungi associated with old-growth or late successional forest (selected ROD "survey and manage species") are potentially present in the watershed. Risk of extirpation for any of these can't yet be estimated.

Fisheries

Coho salmon, fall chinook salmon, summer and winter steelhead and resident rainbow and cutthroat trout have developed robust populations in the past in the Applegate River Watershed. The cooperation of private landowners is paramount to provide the aquatic and riparian habitat necessary for a diverse salmonid fish population in the Applegate River watershed.

The Applegate River has a diverse set of stream and riparian habitats including narrow canyons with steep sideslopes, canyons with some floodplain terraces and wide alluvial valleys. When these varied types of aquatic/riparian habitats are connected and functioning, high salmonid production and diversity is possible. Generally lands under federal ownership and guided by the Aquatic Conservation Strategy of the Northwest Forest Plan contain canyon streams with narrow floodplains. These habitats contain resident trout populations. Steelhead trout are present where upstream migration is possible. Fall chinook salmon, coho salmon, large adult trout and steelhead at times in their freshwater rearing phase are dependent on low gradient valley stream habitat. When canyon stream habitats and alluvial valley stream habitats are connected and functioning, consistent salmonid production and diversity of species and age classes is possible.

At present, management of riparian zones in alluvial valleys is primarily for production of agriculture crops and livestock. Water withdrawals and clearing of riparian forests from alluvial valley streams and canyon streams with floodplain terraces have influenced the diversity and production of salmonids. The usual effects of these activities - elevated stream temperatures and loss of habitat diversity - have been lessened somewhat by the Applegate Dam water releases. This has favored mainstream rearing salmonids e.g. fall chinook mostly, but also steelhead; while coho salmon and large resident trout dependent on complex riverine habitat are probably at a fraction of historic population levels.

The Applegate Dam blocked more than fifty miles of anadromous fish habitat e.g. Carberry Creek., Elliott Creek. and Middle Fork Applegate River and disconnected adfluvial and migratory resident trout movement. The regulation of water from above the dam has altered flow patterns, particularly flood pulses important to stream/floodplain connection. These phenomenon and water withdrawal from tributaries at times when upstream and downstream migration of fish occurs has affected the number of habitat options presented salmonids in the watershed. Total production of fish may be near historic levels e.g. fall chinook, steelhead, bass, bullheads, and trout; but the diversity of salmonid populations in the watershed is probably below historic levels.

Trends in land use indicate that salmonid fish habitat on federal lands will improve with wider protected riparian zones, watershed protection and closing of erosive road networks in headwater canyon streams. Sediment input will decrease and large wood material inputs will increase. Summer stream temperatures will be cooler and winter water temperatures moderated on public lands.

Trends on private lands managed for timber production will improve slightly with revised state forestry guidelines. Road densities in erosive soils e.g. decomposed granite, mica shists, may not decrease. Mature conifers in riparian zones and large wood material in stream channels will remain rare.

Land use in alluvial valleys, primarily agriculture and residential, will continue to keep this important component of the aquatic/riparian habitat in a less-productive condition. Some landowners will voluntarily allow regrowth and protection of riparian forests in these valley habitats, so important to fish and wildlife.

Insects and Disease

Bark beetles (family Scolytidae) and flatheaded wood borers (family Buprestidae) are currently causing extremely high levels of mortality in overstocked forest stands throughout the Applegate River Watershed. The insects are active in riparian stands as well as upslope stands. All pine species, Douglas-fir, and white fir are affected but mortality is greatest in sugar pine and ponderosa pine, especially the larger size classes. Bark beetles and flatheaded wood borers were present in historic stands but caused much less mortality because stand stocking was maintained at much lower levels by frequent fires.

As long as stocking remains high, beetles will continue to kill trees. Given the current conditions of stands in the watershed, no pro-active management will favor tree-killing beetles greatly. The insects will NOT recognize the sanctity of special allocations and will infest trees in overstocked stands in LSRs, riparian buffers, and other parts of the AMA. Components of the most susceptible species, especially large pines, will be greatly reduced or eliminated from substantial areas. The EHA contains a map (map 15) which stratifies the Applegate AMA by relative risk of insect infestation. Risk is highest in lower elevation stands on south and east aspects with high densities but is quite high in all stands. Stocking control of conifer densities could greatly reduce future insect risk.

Port-Orford cedar (*Chamaecyparis lawsoniana*) has a limited distribution in the Applegate River Watershed. It is usually associated with riparian areas and occurs mainly in the Williams sub-basin. Port-Orford cedar root disease (caused by the fungus *Phytophthora lateralis*) is affecting Port-Orford cedar in some places in the Applegate River Watershed. This disease was introduced into the native range of the host in the 1950s and is extremely damaging on sites favorable for the causal pathogen. High risk areas for infection are stream courses, drainages, or low lying areas downslope from already-present infection centers or below roads and trails where new inoculum can be introduced. There has been concern that Port-Orford cedar root disease indeed threatens its host with extinction. This is extremely unlikely because Port-Orford cedar is a very prolific seed producer and because many stands by virtue of their locations have a high probability of escaping disease introduction. Nonetheless, the disease kills numerous Port-Orford cedars and can greatly affect some stand components, especially the large tree components, on affected sites.

The main vector of *P. lateralis* is man. Long distance spread results from moving infected seedlings and, especially, infested soil into disease-free sites. Major spread of the disease is likely to be associated with road construction and maintenance, logging, and traffic flow on forest roads, particularly during wet periods.

Wildlife

Human activities that affect natural processes within the watershed are of two main types. The first type includes farming, grazing and rural development in valley bottoms, riparian zones and low elevation woodlands and forests. The second type of human activity in the watershed that should be considered is past and future forest management on public and private forest lands. For wildlife species and communities within the watershed, these are the human activities that have and continue to have the greatest impacts. These activities affect wildlife species and wildlife community occurrence, stability, dispersal and migration. Both types of activities have influenced habitat quality, connectivity, and fragmentation.

Human settlement is affecting processes and habitat in low elevational forests. Oak woodlands and open ponderosa pine stands have been the most heavily impacted from our settlement practices. Homes dot this area, disturbance is created by humans and their domestic animals, fire suppression increases stand densities, snags are removed to reduce the risk of home loss from wildfire and the water needs of local residences all negatively impact the quality, amount and connectivity of habitats for many native wildlife species and communities.

Changes brought about by fire suppression and development in oak woodlands are significantly altering their habitat quality. Many of the large open grown oak trees are being replaced by those grown in more crowded conditions limiting their canopy development and limb structure and size. Within these oak communities, cavities in living and dead oaks of sufficient size are needed for many species as nests, dens and roosts. The loss of these "savannah" type oaks will continue to contribute to the decline of several species , e.g. acorn woodpecker, Lewis woodpecker, and ash throated flycatcher.

Large, mature ponderosa and sugar pine are being lost in the watershed at an increasing rate. The loss of pine is due to the encroachment of shrub and other conifer species as a result of fire suppression. Loss of pine stands, lack of replacement stands and mortality salvage threaten existing and future supplies of high quality snag habitat. Pine stands in their natural condition were relatively open with a variety of grasses and forbs available as wildlife forage. Living, large pine trees provide food and shelter, and as snags, large pine trees continue to provide nest sites required by cavity dependent species as well as maternity and roost sites for bats. In the short term the abundance of snags resulting from the current high levels of pine mortality will benefit wildlife species dependent on them. However, these stands are not being replaced and future habitat will be greatly diminished.

Although data are not available for current condition of snag levels across the watershed, past logging has left managed stands with fewer snags needed to support populations of primary and secondary cavity nesters. Mortality salvage and removal of snags for safety purposes has removed some snag habitat in most plant series and seral stages across the watershed. Positive benefits of the recent creation of snags due to drought stress should modify past negative effects to some degree but these benefits are not distributed spatially or temporally throughout the watershed. Effective snag management must consider the spatial arrangement, size, decay stage and species of snags as well as overall numbers.

Dispersal and migration for wildlife species associated with late successional forests within the watershed should be provided for by maintaining at least 15% of each sub-watershed in mature/late successional forest and riparian reserves. The intent of this goal is to allow for dispersal and migration of less mobile late successional forest associated species within and between watersheds and to adjoining LSRs. Spatial and temporal arrangements of this habitat as well as site capability will be important when considering short and long term needs of wildlife species.

Riparian areas function not only as dispersal and migration pathways but also suitable habitat for many of the watershed's indigenous species such as the fisher and beaver. Stream and river flows and channels have changed, riparian vegetation has been altered by clearing of the land or introduction of non-native species, and private homes interrupt the connectivity and suitability of habitat that once occurred in these productive riparian areas. These areas no longer contribute as much to wildlife species and wildlife community diversity as that they once did.

Given the data available and the scale of this assessment, it cannot be determined if the riparian zones are functioning adequately for species dispersal and migration, particularly in the mid and higher elevations of the watershed. Many acres have been managed for timber production in the past and do not now contain the structure and closed canopies necessary for species such as the tailed frog,

American marten or hermit warbler. Additional negative impacts to the habitat in these areas occur in streams paralleled by roads, inadequate culverts at stream crossings, and improper grazing. Site specific analysis at the subwatershed or drainage level will be needed to assess the functional capability of riparian zones as wildlife habitat.

B. Recommendations

Only the most important recommendations have been forwarded to the Executive Summary.

Fisheries

- Initiate an effective information-sharing effort with residents of the Applegate River watershed. Communicate aquatic and riparian issues to residents of the watershed; illustrating how actions influence the production and diversity of anadromous and resident salmonids, other aquatic and riparian fauna.
- Continue to protect and carefully manage upslope and headwater areas on public and private lands where many stream processes initiate.
- Inventory and map quality salmonid habitat, particularly in the critical sub-watersheds named in this document: Slate Creek, Cheney Creek, Williams Creek, Thompson Creek and the Federal key watersheds - Beaver Creek, Palmer Creek, Little Applegate River and Yale Creek.
- Draw up conservation and restoration strategies for these sub-watersheds, considering the processes and functions outlined in this and other documents on Siskiyou mountain streams and processes.
- Inventory road crossings and provide fish passage at all flow conditions.
- Address land use issues in alluviated canyons and alluvial valleys, prioritizing areas adjacent and downstream from federal lands producing cool water suitable for salmonids. These uses are primarily agriculture, timber and residential activities. Project work in these habitats will be dictated by cooperation of private landowners.
- Accomplish water conservation in tributaries not supplemented by water releases from Applegate Lake to re-connect these aquatic habitats with the main river at critical periods in the spring and summer. Priority will be in critical sub-watersheds, but private landowner participation may direct where this is accomplished.
- Reclaim riparian zones where possible and promote growth to a mature forest condition, where appropriate.
- Monitor and re-inventory aquatic/riparian habitats, stream temperatures and fish populations at regular intervals, particularly in tributaries, to assess trends.

Vegetation

1. Implement a comprehensive program to control the spread of non-native species and noxious weeds in the watershed. Focus on prevention as the most economical means of control. In addition:

    a) Prescribed burning and thinning for density management should be done in a manner that minimizes spread of these species.

    b) On rangelands, use grazing systems that discourage the spread of these species and encourage native perennial grasses. More intensive herding, timing, rotation and rest systems, or removing livestock are appropriate strategies.

    c) Begin small scale restoration on wildlands where non-natives have taken over. Test burning, seeding, grazing, and other methods to find appropriate and economical methods. Then apply these methods on a larger scale.

    d) Try direct eradication where new non-natives are entering the watershed or important areas for the first time, or where infestations are small and isolated.

2. Begin (or in a few cases, continue) monitoring populations of species identified as having a high risk of extirpation (Table 11). Begin changes in management, and restoration/enhancement projects for those high risk species that are likely to benefit from it. The species identified in the EHA (pgs. 33-36) are the highest priority for both monitoring and restoration activity.

3. Begin monitoring and restoration/enhancement activities for the plant communities considered at high risk of extirpation, listed in the EHA (pages 32-34).

4. Examine opportunities to "speed up" development of stands to late-successional characteristics. Choose areas that are capable, and increase existing late-successional spatial size and connectivity.

Insects and Disease

1. As identified in the EHA, density management treatments are needed to reduce bark beetle and woodboorer-caused mortality in overstocked forest stands in the Applegate AMA. This is an especially critical need in stands with important pine components, whether in upslope or riparian situations. Wildlife habitat needs should be considered when designing any thinning treatments.

2. Special management efforts should be made to protect uninfected Port-Orford cedar in the AMA from the root disease caused by *Phytophthora lateralis*.

Wildlife

➢ Minimize fragmentation and maintain and restore connectivity and of late-successional forests within and between sub-watersheds.

- Maintain and restore terrestrial and aquatic late-successional habitat within LSRs and plan for their connectivity to each other on spatial and temporal scales.
- Restore oak woodlands and pine plant series to their natural condition and locations within the low-elevation/south aspect lands within the watershed.
- Sub-watersheds should be further inventoried for snag attributes (size, numbers, species, decay stage, spatial arrangement) and wildlife species use and needs considered before current snag habitat conditions can be adequately displayed.
- Restore surface water and riparian associated plant communities to streams, seeps, springs and ponds to provide habitat for viable populations of indigenous amphibian and invertebrates.
- Restore moist mountain meadows and low-mid elevation dry grasslands to natural species composition to provide for indigenous wildlife species.
- Reduce number of miles of open road densities below existing levels. Prioritize roads for closure with considerations for resources at risk (riparian, wildlife) as well as access for timber removal.
- Concentrate management activities in reforestation, young and mid seral stands to promote their development into mature/late-successional forest and encourage vegetation species diversity.

Chapter II - Acknowledgments

A team of resource specialists was assembled in December 1994 to continue the task of analyzing the health of the ecosystem in the Applegate Watershed. This assessment will be added to the Applegate Adaptive Management Area Ecosystem Health Assessment (September 1994). The following individuals were members of the core team assigned to assess the aquatic, wildlife, and special plant habitats of the Applegate Watershed: **Mike Amaranthus** (Research Biologist, Pacific Northwest Research Station); **Melanie V. Anderson** (Forest Fisheries Biologist, Rogue River National Forest); **Jon Brazier** (Forest Hydrologist, Rogue River National Forest); **Laura Finley** (Wildlife Biologist, Medford District Office of the BLM/Grants Pass Resource Area); **Randy Frick** (Forest Fisheries Biologist, Siskiyou National Forest); **Don Goheen** (Zone Entomologist, Rogue River National Forest); **Tom Lavagnino** (Facilitator/Writer/Editor, Applegate Ranger District/Rogue River National Forest); **Jerry MacLeod** (Fisheries Biologist, Oregon Department of Fish and Game & Oregon Watershed Health Team); **Bob Pierle** (GIS, Medford District Office of the BLM/Ashland Resource Area); **Mark Prchal** (Geologist, Rogue River National Forest); and **Wayne Rolle** (Forest Botanist/ Rogue River National Forest).

Other individuals contributing to this assessment include: **Su Rolle** (AMA Liaison BLM/FS, Medford District Office BLM); **Ed Reilly** (GIS, Applegate Ranger District/Rogue River National Forest); **Tom Atzet** (Area Ecologist, Siskiyou National Forest); and many other individuals through their questions, encouragement and suggestions. Members of the public were invited to an evening open house on December 7, 1994 to express their opinions, concerns and ideas early on during the analysis phase.

Some of the information used in this assessment was obtained from the Applegate Watershed Assessment (11/94) prepared for the State of Oregon Watershed Health Program and the Strategic Water Management Group (SWMG). That document was prepared by the Applegate River Watershed Council.

Additional information was obtained from a draft document called the Rogue Basin Fish Management Plan (DRAFT 10/94) prepared by the Oregon Department of Fish and Wildlife (ODFW) and a Public Advisory Committee. The objective of this plan is to describe how ODFW will manage the fisheries resources of the Rogue River Basin for present and future generations.

The Rogue River National Forest has recently completed a watershed analysis for the Beaver and Palmer Creek Watersheds (1994) which was used by some of the resource specialists in their analysis of the Applegate Watershed. Since complete information was not available for the entire Applegate Watershed, team members choose to utilize the analysis work and inventory from the 25,000 acre Beaver and Palmer Creek Watersheds for a model which may be applied across the larger Applegate Watershed. Also helpful to the team was data gathered from the 70,000 acre Little Applegate River Watershed Team's effort. (This interagency team is one of 12 teams that have been chartered to intensively analyze a Key Watershed over a one-year period. That report is planned for completion in 1995.)

The team would also like to thank the various federal line officials for their continued support in obtaining a clearer picture of the health of the Applegate Watershed. This is an evolving process that must continually be amended as new information becomes available or new strategies developed.

Chapter III - Introduction

This assessment addresses all lands within the 492,730 acre Applegate River Watershed in southwest Oregon. Federal lands within this watershed comprise approximately 295,507 acres and are managed by the USDI Bureau of Land Management, Medford District Office (parts of the **Ashland Resource Area**, and the **Grants Pass Resource Area**), the USDA Forest Service, Rogue River National Forest (the entire **Applegate Ranger District** and the Little Applegate sub-watershed on the **Ashland Ranger District**), the Siskiyou National Forest, (eastern part of the **Galice Ranger District**), and lands owned by the **US Army Corps of Engineers** (but managed by the USDA Forest Service) around Applegate Lake. The remaining lands within the Applegate Watershed (152, 812 acres) consist of State of Oregon, Jackson County and private lands. All federal lands within the Applegate Watershed (295,507 acres) have been designated as either an Adaptive Management Area (273,700 acres) a Late Successional Reserve (50,980 acres) by the Northwest Forest Plan Record of Decision (1994) or is Congressionally Designated Wilderness (16,709 acres). The Late-Successional Reserves within the Applegate Watershed are included in the Adaptive Management boundary. Please refer to **Map 1** (Land Ownership) and **Map 2** (Northwest Forest Plan Land Allocations) contained within the Applegate Adaptive Management Area Ecosystem Health Assessment (9/94) for the location of ownership and land allocations within the Applegate River Watershed..

Figure 03. **Applegate River Watershed** in relation to the Pacific Northwest.

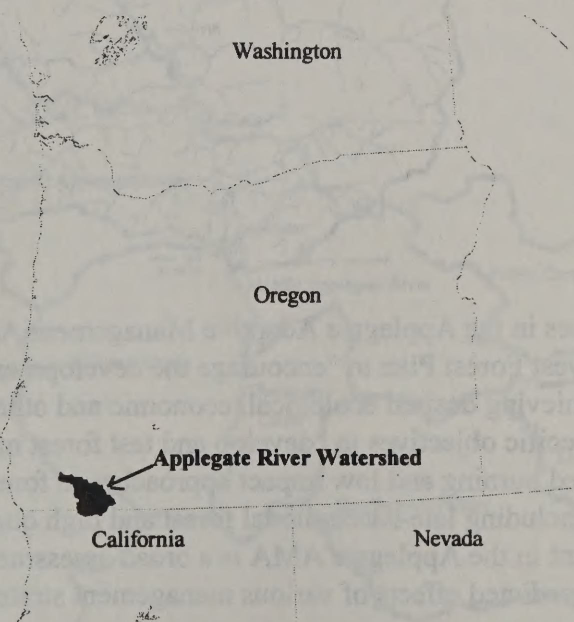


Figure 04. **Locator Map of the Applegate River Watershed** showing geographical references and major rivers and streams.

The 273,100 acres in the Applegate Adaptive Management Area (AMA) is specifically identified in the Northwest Forest Plan to "encourage the development and testing of technical and social approaches to achieving desired ecological, economic and other social objectives." The Applegate AMA has specific objectives to "develop and test forest management practices including partial cutting, prescribed burning and low impact approaches to forest harvest that provide for a broad range of forest values, including late-successional forest and high quality riparian habitat." An essential first step for management in the Applegate AMA is a broad assessment of the issues, processes, conditions, trends and predicted effects of various management strategies.

This analysis has considered many levels of spatial scales in the Pacific Northwest. The team has looked at landscape and watershed scales larger than the Applegate (such as the Rogue Basin at 3,237,120 acres), but is focused on the nine major sub-watersheds of the Applegate Watershed.

Table 01. **Major Sub Watersheds of the Applegate River Watershed** as identified for the purposes of this document.

Applegate River Watershed Sub Watersheds	Acres
Slate Creek	28,412
Lower Applegate River	62,158
Middle Applegate River	41,043
Upper Applegate River	142,168
Little Applegate River	72,240
Williams Creek	51,910
Forest Creek	22,528
Thompson Creek	20,029
Star/Beaver Palmer	52,242
Total	**492,730**

Figure 05 **Major Sub Watersheds of the Applegate River Watershed** as identified for the purposes of this document.

The primary focus of this assessment is on key aquatic, wildlife, and special plant species and habitat in the watershed. It is not the intent to replace project-level planning or resolve social and economic issues. Rather it is an overview- to provide the context at various scales for managing aquatic, wildlife and special plant resources and habitat. Important processes, current conditions, and management strategies are also identified for these resources. This assessment will assist subsequent watershed analysis and project planning work by framing how the planned activity fits with the entire watershed. The ensuing project plan will address the scale appropriate e.g. sub-watershed or local stream type.

This assessment of the health of an ecosystem (at the Applegate River Watershed scale) plays an important role in providing for the protection and identification of aquatic and riparian habitats. Key processes and functions are identified within the watershed which are important for maintaining a healthy ecosystem and opportunities can be planned for their restoration during future project level analysis.

Key questions addressed in this assessment include:

- What are the Historic and Current Conditions, and Trends of the Aquatic, Wildlife, and Special Plant Habitats of the Applegate River Watershed?

- What are some strategies/recommendations to maintain the long-term viability of the Aquatic, Wildlife, and Special Plant Habitats of the Applegate River Watershed?

One way to describe this effort is to use a "three-ring binder" analogy. The Applegate Adaptive Management Area Ecosystem Health Assessment (**EHA**) was the first entry into the binder completed and evaluated the overall ecological health of the watershed. The primary focus of the Applegate Ecological Health Assessment was the long-term health of the terrestrial component of the Applegate AMA. Key issues centered around the relationship between tree mortality, fire suppression, drought and the susceptibility of trees to catastrophic effects of insects and disease and wildfire. This assessment focuses on aquatic, wildlife and special plant species and habitat in the entire watershed and is the next section to be added to three ring binder. Other assessments will follow or be updated and added to the binder. Monitoring is an essential aspect of adaptive management and our binder reflects the iterative process that incorporates new information and knowledge in managing the AMA's.

This analysis concentrates on collecting and compiling existing data within the Applegate Watershed which is essential for making sound resource management decisions. It will be an analytical process, **not a decision-making process** with a proposed action requiring NEPA documentation. It is designed as a basis for developing project-specific proposals, and determining monitoring and restoration needs within the Applegate Watershed.

In April 1993, President Clinton commissioned an interagency scientific team to develop a set of alternatives for management of forested ecosystems within the range of the northern spotted owl. That effort culminated in the report by the Forest Ecosystem Management Assessment Team (FEMAT), entitled Forest Ecosystem Management: An Ecological, Economic, and Social Assessment in July of 1993.

Due to accelerated concerns about the declining fish resources, protection and improvement of aquatic and riparian ecosystems are key components of the FEMAT report, which presents a broad strategy for maintaining or restoring the distribution, diversity, and complexity of watershed and landscape-scale processes and characteristics under which aquatic species have evolved. Watershed analysis is one of the four components of this Aquatic Conservation Strategy (ACS).

The team assembled to analyze the Applegate River Watershed utilized the eight steps outlined in: A Federal Agency Guide for Pilot Watershed Analysis (Jan 1994). Briefly, those eight steps were:

1) identify issues, describe desired conditions, formulate key questions;
2) identify key processes, functions, and conditions;
3) stratify the watershed;
4) assemble analytic information;
5) describe past and current watershed conditions;
6) describe conditions, trends, and predict effects of future land management;
7) integrate, interpret, and present findings, and;
8) manage information, monitor, and revise.

Limitations of Available Information and Data:

The team assigned to analyze the Aquatic, Wildlife and Special Plant Species Habitat for Applegate River Watershed was chartered for a two-week block of time in December of 1994 to assemble existing data and recommend actions to improve or identify work needed to restore the health of the watershed. The team continued to edit the master document and conducted additional meetings over the next few months. Geographic Information Systems (GIS), including different hardware configurations from the two federal agencies were utilized as an integral part for this analysis. GIS departments compiled available information layers to produce limited or sometimes incomplete data sets. The level of accuracy or the confidence of the data varied for some areas (mainly non-federal ownership). The GIS technology and available data layers are constantly evolving and improving. At this stage of development GIS proved to be a valuable tool but limited in the completeness of information. This analysis was designed to utilize "off-the-shelf" or existing information to conduct a watershed based analysis for the 492,730 acre watershed.

One significant data gap identified during analysis was the stream layer. The Forest Service and the BLM used different criteria in identifying which streams or watercourses to display for riparian protection. Forest Ecosystem Management Assessment Team (FEMAT) stream buffers varied significantly across and within the agencies. Team members from this assessment have assumed that data intensively collected from the Beaver-Palmer Creek Watersheds or the Little Applegate River Watershed were representative of the larger Applegate River watershed.

The vegetation layer in GIS was another major information need or gap identified. An existing remote sensing contract utilizing satellite data was useful and could have played a more important role during analysis but it only covered the southern portion of the Applegate River watershed. In the future, the entire Applegate River watershed will be mapped using the same satellite coverage and provide consistent vegetative data for analysis.

Chapter IV - Regional and Provincial Perspectives

Across the Pacific Northwest 24.4 million acres of Forest Service, BLM, and other federally adminis lands within the range of the northern spotted owl are allocated to several designations that effect aquatic, wildlife and special plant species and habitat (ROD, Northwest Forest Plan). Congressionally reserved land such as Wildernesses, Wild and Scenic Rivers and National Monuments cover approximately 7.3 million acr and are restricted from timber harvest. Late-successional reserve areas, covering 7.4 million acres are not automatically restricted from timber harvest, however activities are evaluated as to weather they would caus effects to late successional reserve objectives. Restrictions may be applied where activities are extensive an determined to have significant effects on late successional habitat . Similarly in Riparian Reserve areas, (estimated at 2.6 million acres) harvest activities are evaluated as they may affect the attainment of the Aqu Conservation Strategy. Activities that retard or prevent attainment of Aquatic Conservation strategy are restricted. Watershed Analysis is required in Key Watersheds and Riparian Reserves to determine how pro land management activities will meet Aquatic Conservation Strategies.

Geology

The Watershed is entirely within the Klamath Mountains Geologic Province, also called the Siskiyou Mountains. This province consists of four belts of rock that in a curved fashion roughly parallel the West Coast of northern California and southern Oregon. These belts are progressively younger as they approach the coast, ranging in age from 350-to-153 million years in age. They consist of a complex collection of collapsed back-arc-basins and accreted terranes with the older of any adjacent belt thrust faulted over the top of its younger companion.

In the area of the Watershed only two of these belts are present. Each of these belts was originally a section of ocean crust approximately 7 kilometers (+4 miles) in thickness. About 153 million years ago the older belt was thrust faulted over the top of the younger belt for a minimum distance of 100 kilometers (62 miles).

Over most of the last 150 million years, this area was relatively flat. Relief was gentle and thick lateritic soils covered the landscape. Laterites are mined today in the Southwest Oregon Province at the only operating nickel mine in the USA.

Starting about 14 million years ago and continuing through the present, the area around the Watershed was uplifted. The uplift was centered under Condrey Mountain on the Rogue and Klamath River Divide, and is referred to in geologic literature as the Condrey Mountain Dome. The Condrey Mountain Dome was uplifted a minimum of **7 km (+23,000 feet)** in elevation. As the Condrey Mountain Dome was uplifted the surrounding area also rose and tilted.

With this great increase in relief the 7 km thick upper plate quickly eroded away exposing a window into the underlying plate. This window is several hundred square miles in size. Approximately 75 square miles of the Condrey Mountain Dome is on the Applegate Ranger District.

This erosion which removed over **20,000 vertical feet** of rock that once covered the headwaters of the Watershed resulted in high levels of sedimentation. Deposition of sediments from this erosion is responsible for the broad, relatively flat valley floors seen in the lower section of the mainstem Applegate River and the Williams and Illinois Valley.

Increased relief resulted in the steeply incised streams and slopes characteristic of the upper Watershed. The present day Watershed was sculpted from the Earth by raveling, earthflows, debris torrents and glaciers which acted as the dominant forms of mass wasting.

The uplift of the Condrey Mountain Dome occurred in periodic events. This uplift is thought to continue today, though at a much slower rate.

The geology of the Watershed can be stratified with regard to slope stability and soils characteristics into: granite, graphite schist, serpentine, and other metamorphic rocks (slump and earthflow terrain).

As the older ocean crust slid for 100 kilometers (62 miles) over the top of the younger ocean crust rocks were sheared and juxtaposed with rocks from other levels of this 7 km (+4 mile) thick slab of ocean floor. Heat and pressure produced by sliding and thickening changed the minerals present into others that are more typical of the higher temperature and pressures.

Additional geologic perspectives include:

- In the upper portion of this 7 km thick layer are ocean floor sediments and coral reefs, now changed into limestone, and marble.
- Between the overlying sediments and the volcanic rocks below are sometimes found massive sulfide deposits. These are gold, platinum, cobalt, mercury, silver, copper and chrome minerals deposited by hot springs found near spreading centers. All ocean floors were created at spreading centers, and could be covered with these mineral deposits.
- Pressure and temperature increases induced peridotite in the lowest portion of the upper plate to change into talc rich serpentine; serpentine rock almost always has some asbestos in it. Edges of most large intact blocks in the upper part of the resulting melange were also separated from one another by serpentine.
- Pressure and temperature increases between these two massive sliding plates also induced the sediments in the upper portion of the lower plate to re-crystallize into the graphite schists found extensively on the Condrey Mountain Dome. As is fitting for ocean floor muds that have had a four mile thick slab of rock slide over it for a distance of 60 miles, the graphite schists are extremely weak and landslide prone; some describe these rocks as dissoluble in water.
- Intruded through both levels of these supra-imposed oceanic floors are pods of granite. Intrusions often deposit precious minerals in the surrounding area. Granite weathers into a coarse sand-like residue called grus. Grus has no clay to hold particles together. As a result, streams and/or wet areas in granitic terrane have a high rate of debris slides. Grus damages fish habitat by filling the open space between cobbles.

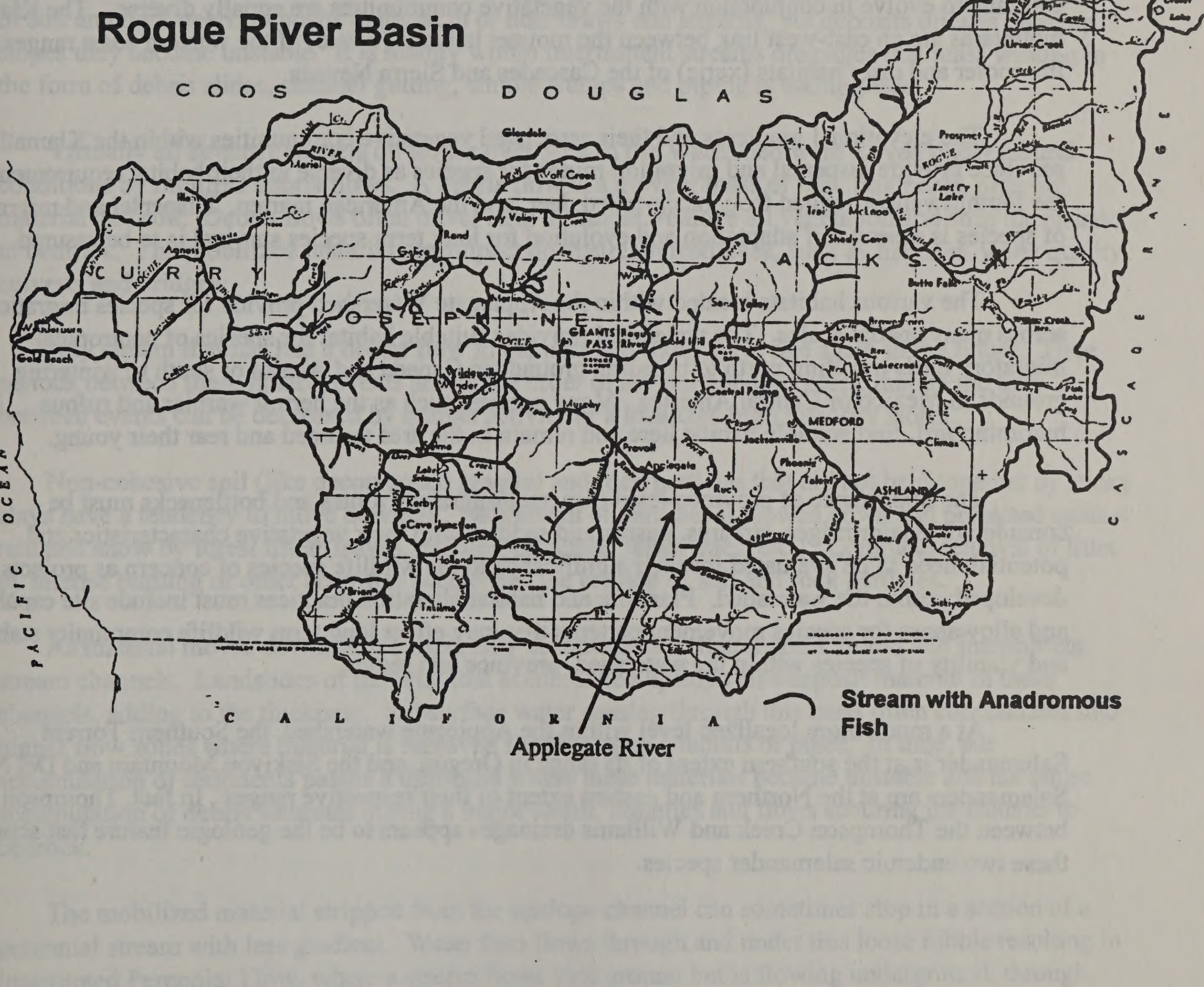
Hydrology and Fisheries

A major issue is the future health and survival of anadromous fish stocks within the basin. The Rogue River basin is considered by the Oregon Department of Fish and Wildlife to be one of the two highest priority systems in Oregon. The Rogue River is the largest coastal basin in Oregon and considered by the State the largest producer of salmon and steelhead. Anadromous stocks include: Coho salmon (*Oncorhynchus kisutch*), spring and fall chinook salmon (*O. tshawytscha*), summer and winter steelhead trout (*O. mykiss*), and sea-run cutthroat trout (*O. clarkii*). Coho and steelhead are presently under status review as candidates for federal listing under the Endangered Species Act.

Nehlsen et al (1991) identified 314 stocks of anadromous at risk. Included in this list of salmonids at moderate risk of extinction were coho salmon in the Rogue River basin. Subsequently coho salmon were petitioned for listing under the Endangered Species Act (ESA). Steelhead were also under status review by the National Marine Fisheries Service. On March 16, 1995 steelhead were proposed for listing as threatened from Cape Blanco south to the Klamath River. This stock was designated the Klamath Mountains Province steelhead stock. The range of this stock includes the Applegate River watershed.

The Applegate River contains all of the above species with the exception of spring chinook salmon. The presence, abundance and extent of range for searun cutthroat in the Applegate River is unknown. Coho salmon are considered “depressed” in the Applegate River by the Oregon Department of Fish and Wildlife (Nickelson et al. 1992). It is likely that the National Marine Fisheries Service will soon propose that coho salmon be listed as threatened.

Figure 06 Rogue Basin Map



Vegetation

A regional and provincial perspective on vegetation is provided in the Applegate Adaptive Management Area Ecosystem Health Assessment (EHA), pages 11-13.

Wildlife

The Klamath Province, as noted by the earlier Applegate Adaptive Management Area Ecological Health Assessment and by Whittaker (1960, 1961), is a vegetatively diverse area due to its geologic history, current landforms and climates. The wildlife species and communities that evolved and continue to evolve in conjunction with the vegetative communities are equally diverse. The Klamath mountains are an east-west link between the moister habitats (mesic) of the western coast ranges and the cooler and drier habitats (xeric) of the Cascades and Sierra Nevada.

The elevational gradients and their associated vegetative communities within the Klamath province provide dispersal and migration routes for species as diverse in their habitat requirements as the foothill yellow-legged frog, black-tailed deer, and the American marten. Dispersal and migration of species is essential if adaptation and evolution for long term species survival is to be assured.

The various habitats located within the Applegate Watershed provide for species migration across many spatial scales. The watershed provides suitable habitat for species of neotropical migratory birds traveling north to breeding grounds in Canada and Alaska or south to wintering grounds in Mexico or Central America. Many species, such as the hermit warbler and rufous hummingbird, find suitable habitat here and remain in the area to breed and rear their young.

The importance of province-level dispersal/migratory routes and bottlenecks must be considered. Major ridges, streams, passes and saddles with their vegetative characteristics and potential, need to be evaluated for their significance to the wildlife species of concern as projects are developed within the watershed. Planning and habitat alteration practices must include site capability and allowances for species movement patterns that may effect long term wildlife community stability and viability of species within the watershed, province and region.

At a much more localized level within the Applegate watershed, the Southern Torrent Salamander is at the southern extent of its range in Oregon, and the Siskiyou Mountain and Del Norte Salamanders are at the Northern and eastern extent of their respective ranges. In fact, Thompson ridge between the Thompson Creek and Williams drainages appears to be the geologic feature that separates these two endemic salamander species.

Chapter V - Key Processes And Functions

Geology

The primary mass-wasting processes in the Applegate River Watershed are from: raveling on steep slopes, debris slides concentrated in or near the drainages and earthflows in graphite schist and clay rich soils are the primary mass-wasting processes at work.

Ravel is found in patches throughout the Applegate Watershed. This steady downhill movement of soil and rock debris deposits material in or near draws and streams. As deposits thicken on steep slopes they become unstable. It is mainly within intermittent streams drainages that mass wasting in the form of debris slides, channel gutting, simple slumps and piping is taking place.

Virtually all stream channels on slopes over 30% in the Watershed were carved under natural conditions by multiple debris flows. A debris flow is a moving mass of rock fragments, organic material and soil. Debris flows often travel long distances, remove all vegetation and strip the channel to bedrock. The mobilized material can impact downstream resources, such as fisheries, water quality, culverts and bridges.

Any stream that has had a debris flow in the past will likely have one again in the future. Time periods between these natural events are on the order of several hundred years, though the time between events can be decreased by human activity or a localized high intensity storm.

Non-cohesive soil (like decomposed granite) and rock particles that are not held together by sticky clays have a tendency to move downhill. Movement of particles is slowed down and protected against rain and snow by forest litter (leaves, needles, branches, fallen trees, etc.). Complete removal of litter by intense burning or other activities accelerates the erosion of soil and rock particles.

As material moves downhill it temporarily accumulates in flatter areas, draws and intermittent stream channels. Landslides of material that accumulated upslope also deposit material in these channels, adding to the thickness. Subsurface water passing through this mass often concentrates into higher flow zones where material is removed forming open conduits or pipes. In time, the accumulation of sediments passes a threshold where these materials become unstable and the entire accumulation of debris saturates during a major storm, liquefies and flows scouring the channel to bedrock.

The mobilized material stripped from the upslope channel can sometimes stop in a section of a perennial stream with less gradient. Water then flows through and under this loose rubble resulting in Interrupted Perennial Flow, where a stream flows year around but is flowing underground, through piping holes, in some sections of the channel. Water can often be seen and heard flowing below the surface under this debris. With continued deposition stream reaches characterized by interrupted perennial flow can become saturated during storm events and move again.

Metamorphic rock, especially serpentine and metasedimentary rock, weather to clay-dominated soils. Clay has great moisture holding capability and also is cohesive. As these clay-rich soils become thick (10 to 100 feet thick) and heavy with moisture, gravity often causes them to ooze slowly downhill as a type of landslide called an earthflow.

Massive landslide scarps, benches and related geomorphic features indicative of earthflows during the ice age are still present, but often these features are inactive except for the break-in-slope of benches and streams adjacent to these features, where slumps and debris torrents still occur. Sediment from earthflows typically has a high silt and clay content.

Some types of clays often have a high shrink/swell capability, expanding up to eight times their volume when saturated and shrinking when dry. This is destructive in that it tends to dislodge rock and soil fragments and could possibly affect structures placed on them.

Clay soils can be a detriment to plant growth when compacted. When compacted the small size and attraction of clay particles tightly fill the spaces between all other soil components, resulting in a nearly solid mass that may not let air and water pass through.

Once compacted it is difficult to return clay soils to an noncompacted state. Tilling compacted clay-rich soil breaks the soil into clods that when wet flow back into a semisolid mass.

Some types of clays often have a high shrink/swell capability, expanding up to eight times their volume when saturated and shrinking when dry. This is destructive in that it tends to dislodge rock and soil fragments and may possibly affect structures placed on them.

Functions Of Unstable Terrain

Talus is a product of rock falls and serves several functions:

- buttresses the toe slopes of cliffs where soft rock erodes out from beneath overlying cliffs, slowing down the erosion of soft sediments and increasing the stability of the overlying rock mass, and;
- provides habitat for salamanders, frogs, marmots, bats, etc. In talus the temperature and moisture conditions vary throughout the depth of the pile, allowing wildlife to migrate up and down to optimize habitat needs during times of stress.

Debris slides are a type of natural event and should not always be considered in a negative way. Since debris slides most often occur during winter and early spring storm events the high flows winnow out mud and silt, keeping them in suspension, leaving clean gravels for fisheries and large woody material for stream structure. Debris slide also:

- refresh the supply of gravels available for fish habitat needs, and;
- supply large woody material from intermittent streams to fish-bearing streams.

Debris filled draws provide:

- moisture sinks, upslope pockets of moist ground that retain moisture longer, and;
- specialized habitat for mountain beaver, amphibians etc.

Earthflows and slumps produce small bodies of water called sag ponds, commonly found below the upper head scarp and interspersed over their surface. Sag ponds are used by amphibians and insects for reproduction and provide habitat for wetland plants.

Sag ponds feed water into the head scarp which lubricates the slide plane, increasing the possibility of future movement and perpetuation of earthflows.

Earthflows and slumps also produce large woody material by pushing over and toppling trees and are:

- used as habitat by rodents, a food source for owls and hawks;
- important moisture sinks during dry periods, and;
- often excellent tree growing sites due to moist conditions and the churning of duff into the lower A and B soil horizons often produces a land type that favors tree growth.

Hydrology and Fisheries

The decline of salmonid production in the Rogue River basin can be attributed to several factors including: freshwater habitat degradation, unfavorable ocean conditions, commercial and recreational fishing pressure, and hatchery impacts on wild fish gene pools. This assessment will deal primarily with freshwater habitat changes. Freshwater habitat conditions include but are not limited to: instream aquatic habitat and function, riparian condition and function, dams and water quantity and quality issues.

The intent of this assessment of watershed processes and functions is to give the reader a sense of where past and future activities fit in the context of the entire Applegate River watershed and its salmonid fish populations. This assessment will assist subsequent watershed analysis and project planning work by framing how the planned activity fits with the entire watershed. The ensuing project plan will address the scale appropriate e.g. sub-watershed or local stream type.

Large Woody Material

Large woody material (LWM) has been found to be relatively infrequent in the surveyed streams, with most streams averaging less than five (5) pieces per mile except the most remote canyons, e.g., Silver Fork has 60 pieces per mile in some segments. Ashland Creek is in pristine condition and is adjacent to the Little Applegate River sub-watershed. This stream has more than 150 pieces of large wood per mile in some stream segments. Large wood is defined in this assessment as having a length greater than fifty feet (50) or longer than twice the bankfull width of the stream. Diameter of large wood is equal to or greater than twenty-four inches (24) at the smaller end. In the streams and forests of the Siskiyou Mountains, this size class seems to be indicative of large wood features in stream channels.

There is evidence that much of this material was removed where there is equipment access to the river channel. Historically, mining, timber and agriculture activities had a tendency to remove large woody material from streams with the intent to protect roads, property, fish habitat and other downstream values.

Research documents the importance of large wood material to the ecology of streams and riparian zones. Anecdotal accounts from long-time residents describe large wood jams, complexes and numerous single pieces in some streams. Lower Sturgis Fork of Carberry Creek once contained log complexes each few hundred feet with large trout associated with the habitat created. This material was re-arranged during the 1964 flood event and much subsequently salvaged from the stream channel. Cottonwood particularly, but also Oregon ash and maple often grow to diameters in excess of twenty-four inches in lower alluvial valley riparian zones. These hardwood features provided large wood component to stream channels in these low gradient areas.

Pools

Pools are well-documented important habitats for adult and juvenile fish. In the lower gradient stream sections - alluvial valley and alluviated canyon streams, the expected frequency of pools would be one pool for each 4 - 9 wetted widths of the stream. Stream surveys and observations indicate fewer pools than expected e.g. 1991 Little Applegate River stream survey, 1990 Steve Fork, Sturgis Fork surveys. Present pool frequency is related to fine and coarse sediment influencing stream morphology, straightening of channels and large of large hardwood and conifer wood pieces in the channel.

High gradient streams segments - bedrock and colluvial canyons, generally would contain more frequent but smaller pools. Many of these would be short step pools or pocket pools, nonetheless of importance to resident trout and steelhead. These stream segments tend to be resilient and transport sediment and wood features and probably have pool frequencies more similar to background levels.

Table 02. Large Wood per Mile and Pools per Mile in the Applegate River Watershed

(Forest Service Stream Survey Data)

Stream Name	Expected Range Pieces of Wood/Mile	Wood/Mile Present	Expected Range Pools/Mile *	Pools/Mile Present	Average Stream Gradient
Palmer Creek	40-150	21	52-106	38	6%
Beaver Creek	40-150	14	52-106	27	4%
Steve Fork	40-150	24	29-56	17	5%
O'Brien Creek	40-150	4	44-88	4	5%
Little Applegate River (Reach 1) **	40-150	41	29-56	23	4%
Little Applegate River (Reach 2 & 3)	40-150	7	31-62	15	2%
Silver Fork (Reach 1 & 2) **	40-150	50	75-150	8	4%
East Fork Ashland Creek **	40-150	170	29-56	38	8%
West Fork Ashland Creek **	40-150	136	52 to 106	3812	10%
Middle Fork Applegate River (Reach 1 to 4)	40-150	3	Reach 1-2=15-30 Reach 3-4=35-70	=10 =42	=2% =5%
Middle Fork Applegate River (Reach 5 to 6)	40-150	25	52-106	50	4.5%
Squaw Creek	40-150	6	48-96	21	4%
Slate Creek	40-150	20	N/A	N/A	4%
Waters Creek	40-150	10	N/A	N/A	10%

* Expected range of pools per mile based on pool frequency of 4 to 9 wetted channel widths.

** These Streams or stream segments are more isolated from direct human activities. Although not pristine, these segments may be more indicative of healthy streams in Siskiyou Mountain geology. Ashland Creek is immediately east of the Little Applegate River in the Bear Creek Watershed. Ashland Creek is managed as municipal watershed. The geology is similar to adjacent Applegate River streams.

Stream Types Affecting Fish Populations and Assemblages

The stream valley types used below are typical of stream types found in the Siskiyou Mountains and borrowed from Frissell, et al, 1986. Some aggregation of the valley types identified by Frissell is accomplished to simplify the discussion. Stream and floodplain function alteration and the effects on salmonid production are displayed. Watershed analysis and project planning work should do a more thorough channel typing and identification of key processes and functions at the scale appropriate.

A. Canyon Stream Segments, Bedrock Canyons, Colluvial Canyons

Examples in the Applegate River Watershed: Middle Fork Applegate River above Elliott Creek, Silver Fork Elliott Creek, O'Brien Creek, McDonald Creek, upper Steve Fork, and upper Slate Creek

Processes & Functions:

narrow stream valley, usually 1-2 bankfull channel widths; steep stream gradient, low width/depth ratios, bedrock and/or boulder streambed, transport sediment and wood, cool summer water temperatures;

- LWM infrequent in complexes at nick points, steep sideslopes and tributaries deliver sediment and wood;
- cascades frequent; pocket pools associated with boulders and step pools.(Rosgen A, B and G channels with C/F inclusions in sediment deposits);
- riffles and cascades important macroinvertebrate production areas, and;
- fish, if present, usually resident rainbow and cutthroat trout, summer steelhead, and winter steelhead if accessible.

Figure 07. **Colluvial Canyons**

Figure 08. **Bedrock Canyons**

B. Alluviated Canyons, Canyons with Terraces

- *Examples in the Applegate River Watershed:* Little Applegate River above Yale Creek, lower Steve Fork and Sturgis Fork, Slate Creek, Thompson Creek, and Forest Creek.

Processes & Functions:

- stream valley is 2 to 3 times the width of bankfull stream width, stream gradient is moderate with some meandering, moderate width/depth ratio, gravel and cobble streambed with boulders, wood in complexes or on terraces, some side channel development;
- more frequent connection of stream with riparian and hillslope vegetation e.g. meanders;
- terrace development with hardwoods provides food for aquatic insects, amphibian habitat;
- lateral scour pools associated with meanders, riffles important for macroinvertebrates. (Rosgen B, G, C and F channels);
- key fish habitat for coho, steelhead and resident trout. Some use by fall chinook. Water temperatures historically cooler than valleys, and;
- productive low-gradient segments (flats) are depositional for wood and sediment, rich biologically.

Figure 09. **Alluviated Canyon**

C. Alluviated Valleys, Unconfined Valley Segments

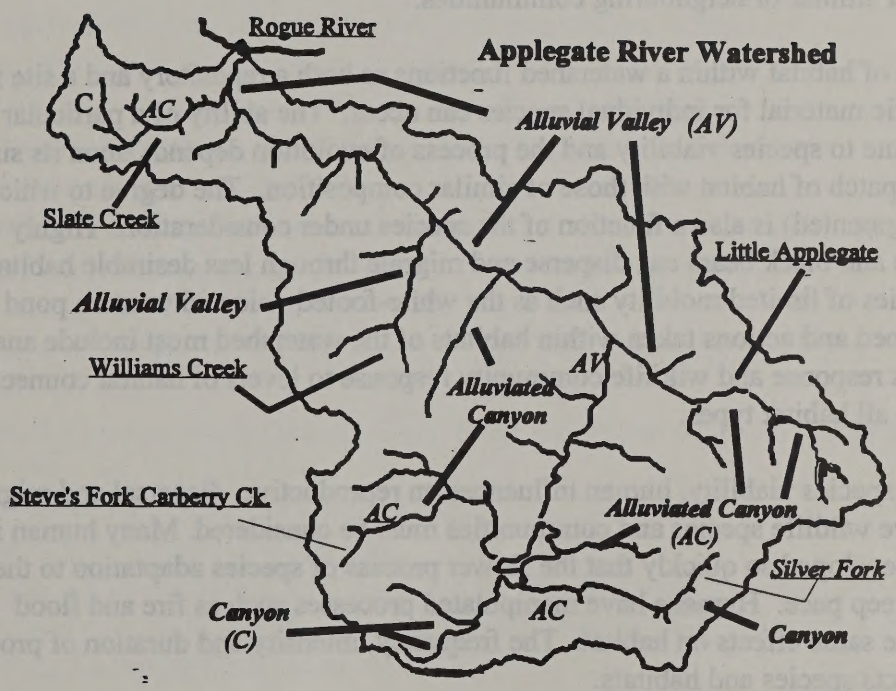
Examples in Applegate River Watershed: Most of Applegate River below Little Applegate River confluence, lower Slate Creek, Little Applegate below Yale Creek confluence, and lower Williams Creek.

Processes & Functions:

- stream valley is greater than three times the bankfull width of stream. Low stream gradient, high width/depth ratios, gravel and cobble streambed, meandering stream channel, extensive side channel development locally;
- floodplains with high water tables, rich biological zones for fur-bearers, herptofauna, fish and waterfowl;
- riffle/pool system with stream working across wide floodplain belt (Rosgen C, D and F channels);
- important fish habitat for all anadromous species, over-wintering habitat for coho salmon and steelhead parr. Large age-class trout associated with complex riverine habitat, and;
- side channels provide refuge from floods and freshets e.g. fall chinook fry. Water temperatures moderated by ground-water - locally cooler in summer and warmer in winter, increased salmonid growth.

Figure 10. **Low Gradient Alluvial Valley Stream, Valley/Bottoms**

Figure 11. Map of Applegate River Watershed Stream Segment Types



Vegetation and Fire

Ecological processes and functions affecting vegetation and fire are discussed in the EHA, pages 6-8. The important role of fire is described in the EHA (pages 45 - 50). Vegetation influences on ecosystem processes and functions are also discussed in the EHA (various pages).

Wildlife

The key processes and functions concerning wildlife species/community survival and viability are quality, quantity and spatial distribution of habitats through time. Elevation, aspect, soil type and composition, fire, flood, diseases, insects, and climate all influence the vegetative communities likely to be present in a given area. This combination of abiotic and vegetative communities determines the adequacy and quality of habitat provided for wildlife communities, and influences their ability to interact with other similar or neighboring communities.

Each type of habitat within a watershed functions as both a repository and a site from which dispersal of genetic material for individual species can occur. The ability of a particular "patch" of habitat to contribute to species viability and the process of evolution depends upon its size and connectivity of a patch of habitat with those of similar composition. The degree to which habitats are connected (or fragmented) is also a function of the species under consideration. Highly mobile species such as goshawks and black bears can disperse and migrate through less desirable habitats with greater success than species of limited mobility such as the white-footed vole and western pond turtle. Strategies developed and actions taken within habitats of the watershed must include analysis of individual species response and wildlife community response to levels of habitat connectivity and fragmentation for all habitat types.

To assure species viability, human influences on reproductive, dispersal and migration processes of native wildlife species and communities must be considered. Many human induced habitat alterations have developed so quickly that the slower process of species adaptation to these changes has not been able to keep pace. Humans have manipulated processes such as fire and flood so that they no longer produce the same effects on habitat. The frequency, intensity and duration of processes cumulatively affects species and habitats.

Species migration and dispersal in the Applegate watershed has evolved with a landscape that in much of the watershed is fragmented due to fire, soils, aspect and climate which allowed for a variety of vegetation types. Migration and dispersal patterns likely shifted over time in response to fire of various intensities affecting the existing vegetation. Fire suppression introduced into the watershed by humans has likely altered habitat use patterns in the watershed. Pine stands, that were once more open, have developed into more dense stands with understories of Douglas-fir and true fir. These stands are providing habitat for at least one late successional species, the northern spotted owl. Another affect of human activity on dispersal and migration is that timber harvest in the watershed has been concentrated in stands located on north and east facing slopes. Forested stands located on these aspects and areas of higher moisture have been the traditional habitat of species such as the spotted

owl. The impacts of this shift in distribution, amounts and quality of habitat cannot be determined from available data on applicable late successional associated species.

The key role of fire as a process within the watershed has been altered, by humans. Suppression of fire has allowed the process that maintained pine-oak stands to be altered causing dense stands and the loss of future large pine and oak stands on many low elevation and south facing slopes. Use of timber harvest alone does not mimic the role of fire for all species in the ecosystem. Many plants need fire for regeneration and invertebrate and vertebrate species tied to those plants for survival will be negatively impacted when harvest is used as surrogate for fire. Indiscriminate logging of dead trees from wildfires and areas of insect activity alters a natural process and removes some of the essential habitat components that increases habitat for species that provide natural insect control (e.g. woodpeckers).

Chapter VI - Historic and Current Conditions and Trends

This chapter will also display a stratification of the watershed and present resource inventories and analytical information where appropriate.

A. Geology

The Applegate Watershed is an area of high natural erosion and sedimentation rates. Some concepts relating to geology within the Watershed are:

- the granites and graphite schist are the most unstable and erosive rocktypes in the watershed, especially with regard to its detrimental impact to spawning and rearing habitat;
- roads and past management activities are not the only cause for high sedimentation rates;
- relatively recent uplift has resulted in slopes that are steep;
- ground disturbing activities can impact these steep slopes;
- vegetation in the riparian reserves impedes down-cutting, caused by both recent uplift and increased and concentrated runoff due to timber harvest and roads;
- some soils erode easily if exposed;
- woody material of all sizes is critical for maintaining surface stability;
- gully erosion has occurred where runoff has concentrated in channels;
- soil organic matter is slow to accumulate;
- removal of litter by burning or forest management practices accelerates the erosion of soil and rock particles;
- the high magnesium content of serpentine and related rocks inhibits growth of many plant types;
- some rare plants on the Watershed may be limited because the type of rocks on which they grow are uncommon in the area;
- outcrops of serpentine, limestone and granite are widely dispersed and often of small extent. Possibly some TE&S species associated with these rocktypes could actually be rare because the rocks needed by them are rare;
- serpentine almost always has some asbestos in it, a hazardous mineral;
- the possibility of finding commercial minerals like gold, copper, mercury and chrome exists on the Applegate Watershed;
- toxic heavy metals (mercury, arsenic, etc.) are often contained in mine talus, and could adversely effect fisheries and humans;
- hydraulic mining has created bare, eroding slopes up to 30 feet high adjacent to stream channels. These high slopes are susceptible to failure when the creek levels get to bankfull widths and flood levels;
- some streams designated intermittent may seasonally provide spawning or rearing habitat for fish;

- many trees growing on sparsely vegetated south facing slopes and ridge tops started growing during the Little Ice Age (1350-to-1870 AD), a period when average temperatures were cooler and precipitation was greater;
- reactivation of ancient landslides could occur through improper road and culvert location and, in some instances, by activities that too intensely disturb the soil;
- clear cut timber harvesting has exacerbated instability by loss of root strength and increasing groundwater available to unstable terrain;
- road building intercepts groundwater and sometimes concentrates the water into areas that can saturate soils and weathered bedrock, increasing the likelihood of slope failures, and;
- instream diversions into agricultural ditches are usually built by use of tractors. These diversions are generally damaged during high winter flow, requiring tractors to rebuild them every spring. The use of tractors to construct diversions damages spawning gravels and the habitat of insects, resulting in a diversion that continuously seeps muds and silts into waterways.

FUTURE TRENDS IN SOILS AND GEOLOGY

- Southern Oregon has been in a drought for eight of the last nine years which has helped some slopes stabilize. However, when moist conditions return, soils could develop a short-term increase in erosion and landslide potential;
- It is likely that problems associated with soil ravel and compaction may continue for some time as delayed affects of harvest methods continue to accrue;
- If soil displacing activities continue into the future then these problems may continue to increase in severity;
- These affects will decrease as results of ongoing rehabilitation projects progress, and;
- This area has some earthquake risk which could trigger landslides (see Appendix).

B. Aquatic, Fisheries, Hydrology, And Riparian Vegetation

Historic Conditions

Prior to Europeans arrival in the area, the Applegate River Watershed looked quite different from today. The upland areas were a mix of forested conditions and open brush, grass, and oak fields. Steep, headwater streams were generally in good condition hydrologically. Channels were stable, with adequate large woody material and had good water quality -- low turbidity levels, low water temperatures, acceptable chemical parameters.

As streams merged with one another, the channels had sufficient size to handle the range of flow conditions that occurred. Channel morphology developed in response to climatic conditions and historic ranges of streamflows.

Lower in the watershed, channel gradients flattened and there were multiple channels in the mainstem of the Applegate River. The diversity provided by the multiple channels provided good habitat for aquatic species of both plants and animals.

Width-to-depth ratios for the river channel were low and water temperatures and nutrient levels lower than today. The range of maximum natural stream temperatures would have been from 46°-72°F.

Current Conditions

With the arrival of European people, conditions in the watershed changed. Mining activities, timber harvest, road construction in the headwaters, farming, and livestock management have all produced notable changes in the watershed. Stream systems are now generally much simpler with: fewer 'multiple-channel' streams, increased width-to-depth ratios, higher stream temperatures, less diversity in the riparian vegetation, higher nutrient levels and flashier streamflows.

The mainstem of the river is now regulated by releases from Applegate Dam. Regulated flows provide lower temperatures in the river than were achievable prior to the dam's completion. Releases from the dam have also assured that there is continuous flow to the mouth of the river throughout the year.; previously, in low water years, the river dried up on occasion at the mouth. Regulation of flows from the dam has created a steadier flow regime with fewer high or low flows. This has in turn allowed riparian vegetation, such as blackberries, to encroach into areas that were once part of the active channel. This vegetation has restricted the size of the active channel and allows for water to flood adjacent areas at lower flows than would have been the case prior to the dam. Many side channels, which provide important rearing habitat for Coho salmon, especially in winter, have become clogged with debris and are no longer functional.

Agricultural and residential development has encroached on the river channel. Streams that once meandered and had abundant off-channel and backwater areas for fish rearing and habitat needs are now unavailable for fish use. Chanelization has resulted in increased velocities and allowed stream channels to downcut and has changed depositional zones into transport zones and effectively removed needed gravels from the system. The Applegate river and tributaries with low gradient stream valleys have become dissociated from their adjacent floodplains lowering water tables in adjacent riparian areas. These formerly flooded areas were rich environments for riparian/aquatic species such as otters, mink, amphibians, and reptiles that prefer such habitats. Most of the low gradient areas discussed are under private ownership.

Aquatic insects that occupy cool lotic habitats are declining in the lower portions of the Applegate River Watershed. This is of concern because these insects are preferred foods of freshwater salmonids. The main causes of decline are elevated stream temperatures and siltation. Large wildfires, major insect and disease-caused mortality events, regeneration harvests, agricultural and residential development along stream banks, road building, mining, grazing, and off-road vehicle use have the potential to increase water temperatures and siltation, resulting in continued insect population declines.

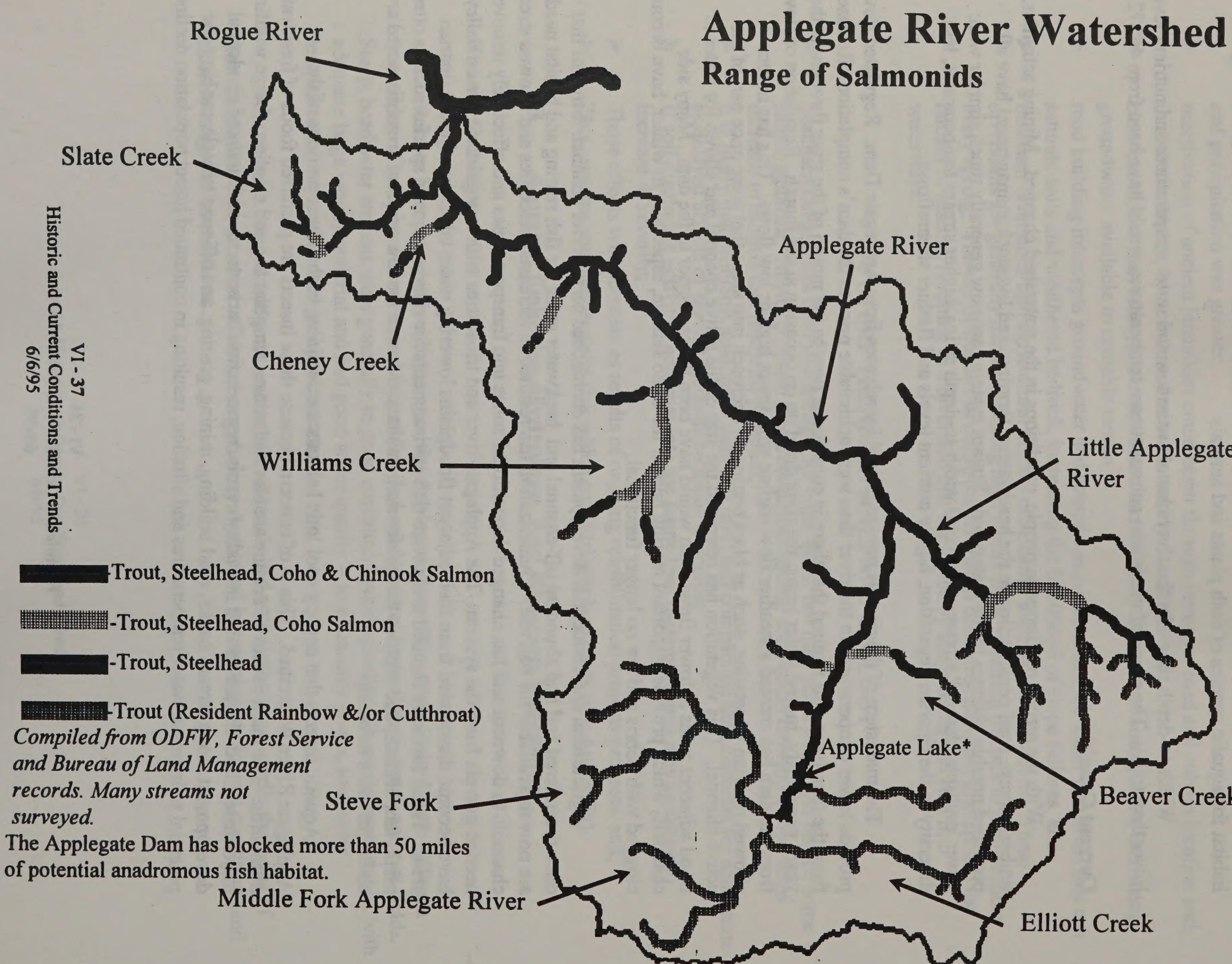


Figure 12. **Applegate River Watershed Range of Salmonids**

The following figures show the range of salmonids in the Applegate River watershed; stream profiles for the Applegate River, Slate Creek and Little Applegate River; and a the typical life history of anadromous salmonids in the Applegate River. These graphics supplement the following information on fish populations, potential fish habitat and fish life history patterns in the Applegate River.

Figure 13. Range of Salmonids (Longitudinal River Profile)

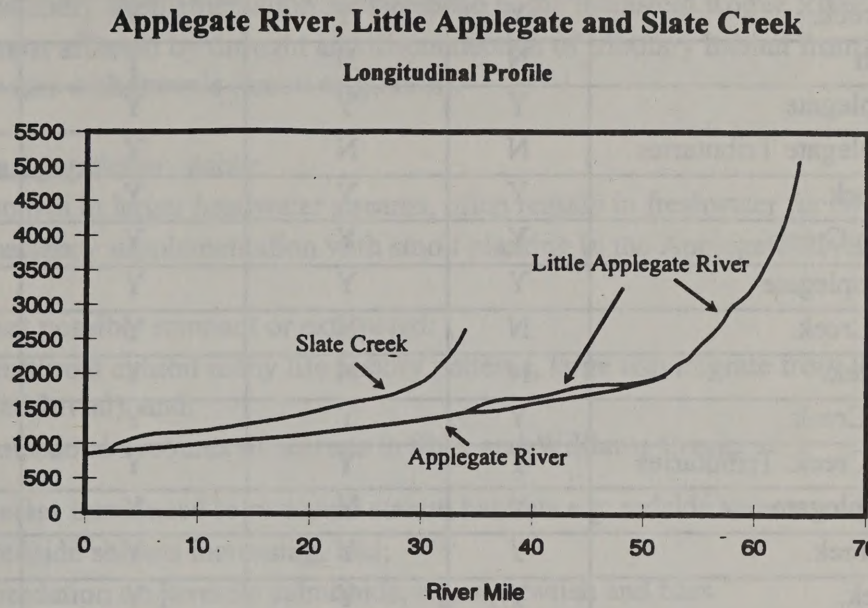


Figure 14. General Life History of Anadromous Salmonids in the Applegate River Watershed.

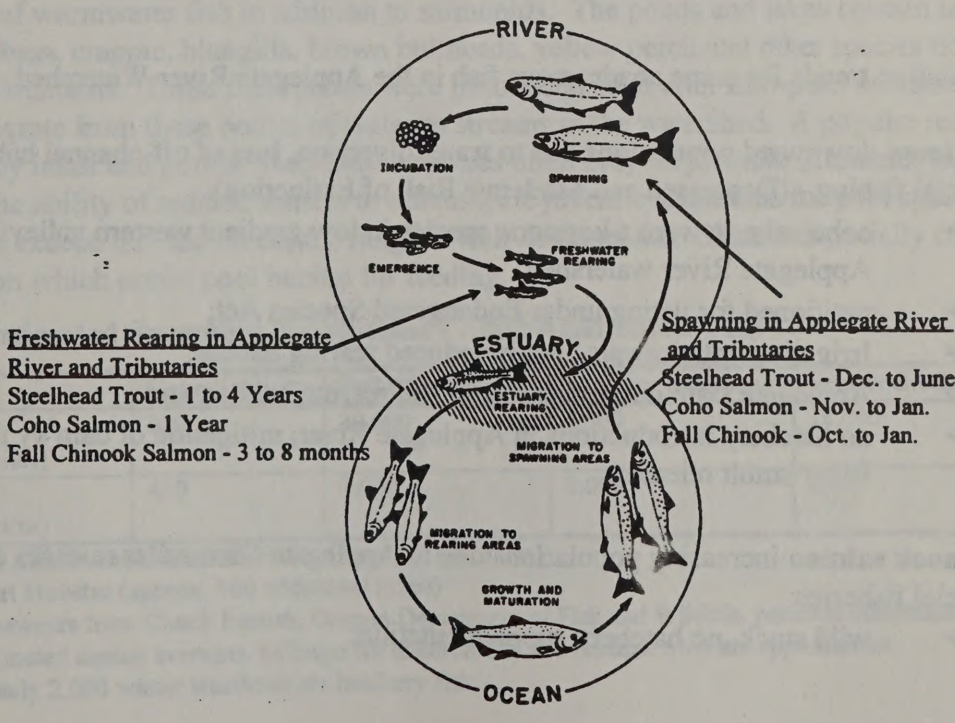


Table 03. **Fish Distribution in the Applegate River Watershed**

SUB-WATERSHED	COHO	FALL CHINOOK	STEELHEAD	RESIDENT TROUT
Upper Applegate Above Dam	N	N	N	Y
Palmer Creek.	Y	Y	Y	Y
Beaver Creek.	Y	Y	Y	Y
Star Gulch	N	N	Y	Y
Little Applegate	Y	Y	Y	Y
Little Applegate Tributaries	N	N	Y	Y
Forest Creek.	Y	Y	Y	Y
Thompson Creek.	Y	Y	Y	Y
Middle Applegate	Y	Y	Y	Y
Humbug Creek.	N	N	Y	Y
Slagle Creek.	N	N	Y	Y
Williams Creek.	Y	Y	Y	Y
Williams Creek. Tributaries	Y	Y	Y	Y
Lower Applegate	Y	Y	Y	Y
Cheney Creek.	Y	Y	Y	Y
Slate Creek.	Y	Y	Y	Y

N = Not present   Y = Present

Trends

Population trends for some anadromous fish in the Applegate River Watershed:

Coho salmon downward populations due to water diversion, loss of off-channel habitat, past commercial fishing - (Depressed and Moderate Risk of Extinction):

- coho salmon were a keystone species in low gradient western valleys as found in the Applegate River watershed
- petitioned for listing under Endangered Species Act;
- Irrigation withdrawals greatly reduced rearing habitat;
- Applegate Dam cut off spawning and rearing habitat, and;
- no hatchery introductions in Applegate River, mitigation of dam by mainstem Rogue River smolt releases.

Fall chinook salmon increasing populations due to Applegate Dam water releases and reduced commercial fisheries:

- wild stock, no hatchery supplementation;

- spawning habitat expanded by fall water releases, attracts adults to upstream habitats consistently every year (no hatchery influence), and;
- generally juveniles migrate from Applegate River before summer, not susceptible to elevated summer water temperatures.

Summer steelhead downward populations due to water diversion and drought:
- utilize small tributaries for spawning, migrate to main river habitats first or second year,
- hatchery supplementation for steelhead in the mainstem Rogue River, and;
- most affected by drought and disconnection of tributary habitat from mainstem due to water withdrawals (smolt migration).

Winter steelhead population stable:
- spawn in larger headwater streams, often remain in freshwater for two or three years, &;
- hatchery supplementation with smolt planting in the Applegate River.

Searun cutthroat possibly remnant or extirpated:
- cutthroat exhibit many life history patterns, large fish migrate from Rogue River (adfluvial), and;
- anecdotal accounts of searuns in Slate and Williams Creek.

Non-Native Species introduced to river and stream habitats e.g. redside shiners and bass:
- redside shiners increasing, and;
- predation on juvenile salmonids, e.g. squawfish and bass.

Applegate Lake, Squaw Lakes and numerous private ponds in the lower watershed contain populations of warmwater fish in addition to salmonids. The ponds and lakes contain largemouth and smallmouth bass, crappie, bluegills, brown bullheads, yellow perch and other species not native west of the Rocky Mountains. These fish species were introduced soon after European settlement and often escape or migrate from these bodies of water to streams in the watershed. A popular recreation fishery is provided by lakes and ponds. Non-native species often prey on juvenile salmonids e.g. squawfish and bass. The ability of redside shiners to outcompete juvenile salmonids for pool space when water temperatures exceed the mid 60 degree range is well documented. Shiners especially compete with young salmon which prefer pool habitat for feeding.

Table 04. **Estimated Spawning Populations** - Adult Anadromous Fish *

	Coho Salmon	Fall Chinook	Summer Steelhead	Winter Steelhead **
Mainstem (Approx. 50 miles)	900	30,000	4,000	18,000
Tributaries (Approx. 75 miles)	450	4,000	2,000	2,000

Total Miles of Anadromous Fish Habitat (Approx. 125 miles)
Resident Trout Habitat (approx. 160 additional miles)
* Estimated spawners from Chuck Fustish, Oregon Department of Fish and Wildlife, personal communication. These figures are estimated annual averages. Mileage for anadromous and resident trout are approximate.
** Approximately 2,000 winter steelhead are hatchery fish.

Tables 05-08. Life History of Applegate River Salmonids

Table 05. **Resident Trout** (Rainbow & Cutthroat)

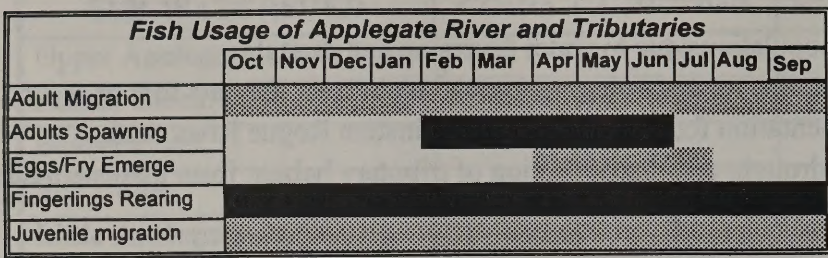


Table 06. **Summer and Winter Steelhead**

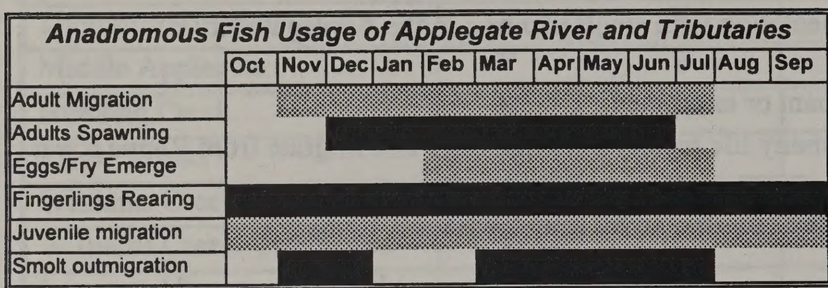


Table 07. **Coho Salmon**

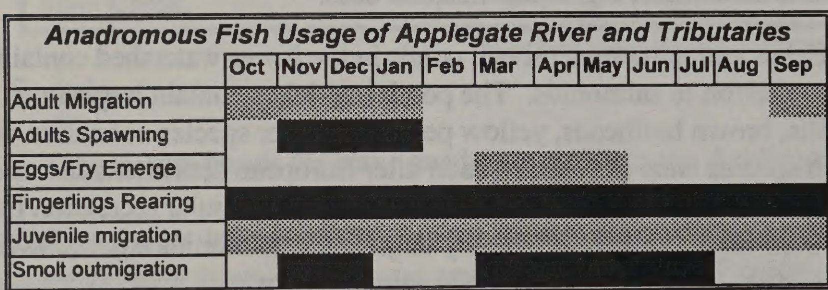
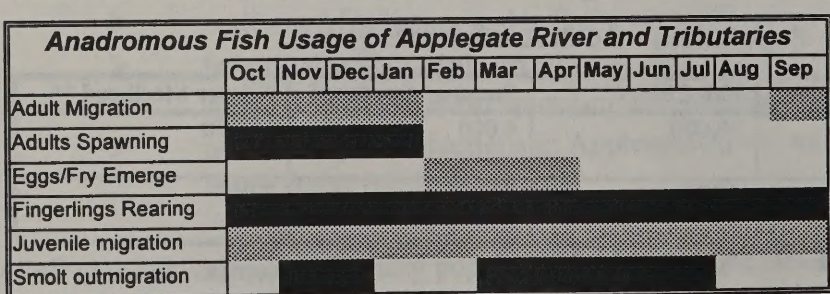


Table 08. **Fall Chinook Salmon**



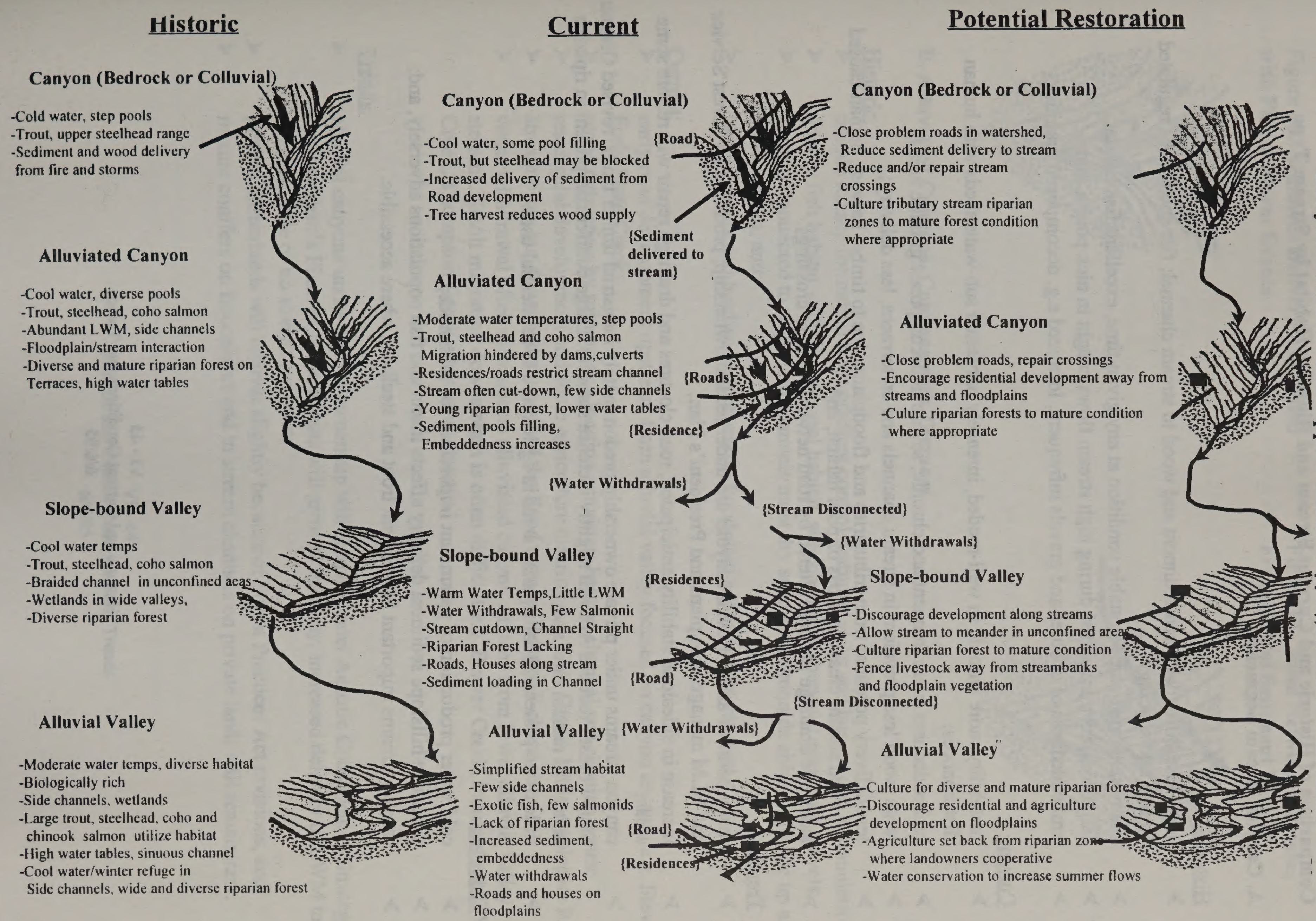


Figure 15. **Summary of Physical Processes and Human Influences on Aquatic and Riparian Ecosystems/Restoration Opportunities - Applegate River Watershed.**

Comparison of Historic and Current Stream and Riparian Habitat by Stream Type

A. Canyon Stream Segments

Historic:
- local instability delivered sediment and wood to stream channel; fire and storms regulated timing and spacing;
- many canyon streams in stable condition at any given time, excellent fish habitat;
- large conifers transported during high stream flows caught in nick points, and;
- embeddedness of cobbles and gravels infrequent, localized e.g. decomposed granitics.

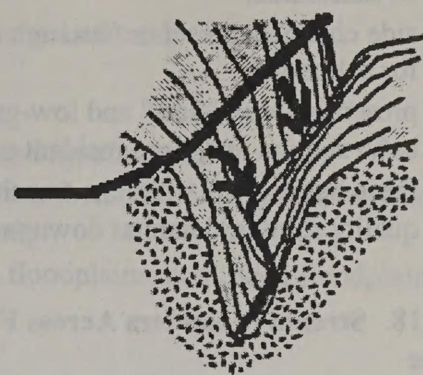
Current:
- instability more chronic in well-roaded, intensely harvested sub-watersheds with human disturbances;
- embeddedness more frequent and chronic, severe in decomposed granitic areas;
- large wood less prevalent in stream channels and on terraces, less delivery;
- less delivery potential from tributaries and floodplains due to timber harvest, human-caused fires and stream cleanout. Loss of pool habitat, and;
- sideslope drainage patterns altered by road network, stream crossings.

Trends:
- many bedrock and colluvial canyons are under federal ownership, protected by Forest Service and BLM management plans and President's Plan;
- increase in sideslope stability anticipated, road closures and drainage repair will restore some areas;
- canyon streams under private ownership predominately industrial timber lands. revised Oregon State Forest Practices Act will slightly increase stability. Large conifer component in riparian areas will remain rare, and;
- little or no protection for riparian areas in agriculture or residential uses.

Fisheries:
- cold water production of paramount importance for salmonids;
- excessive hillslope sediment delivery affects insect and fish populations adversely, and;
- canyon streams important for resident trout and steelhead where accessible.

Figure 16. **Sediment Delivery Associated with Fire & Storm Events**

Figure 17. **Road Network Increases Frequency of Sediment Delivery**



B. Alluviated Canyons, Canyons with Terraces

Historic:

- unique terrace formation from gradient control features, nicks and large wood accumulations;
- quality fish habitat with diverse pool habitat, side channels, abundant spawning gravels;
- streams connected to mainstem channels most dry seasons, salmonids able to migrate up and down stream, and;
- large conifers and hardwoods present on floodplain and in stream channel.

Current:

- early road development upstream from alluvial valley focused on canyon terraces e.g. Steve Fork, Slate Creek;
- wood extraction by mining and logging activities, both in channel and riparian zones;
- residential development and some agriculture clearing e.g. Slate Creek, Little Applegate River;
- stream often cut down and abandoned the flood terrace (Rosgen F channels);
- water withdrawal often disconnects alluviated canyon streams from lower alluvial valley streams. Smolt migration downstream is often difficult e.g. Beaver Creek, Palmer Creek, Yale Creek, Thompson Creek, numerous streams.

Trends:

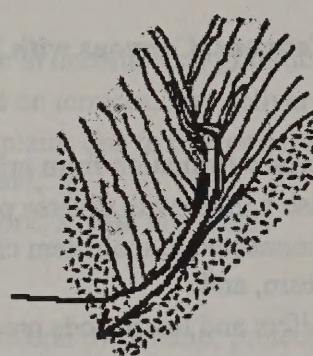
- alluvial canyons under federal ownership will recover under Aquatic Conservation Strategy of the President's Plan. Riparian forests will grow to maturity, increased delivery of LWM to streams, little or no stream cleanout;
- private timberlands will recover slightly because of Forest Practices Act revisions, and;
- mature conifers on floodplains and in stream channels on private lands will remain rare.

Fisheries

- terraces often form biologically productive areas or "flats" important for spawning and rearing of salmonids;
- side channels present often high in the drainage where summer water temperatures are still cool for salmonids;
- presently these "flats" and low-gradient areas may be the only remaining habitat available for coho salmon and large resident trout, and;
- these habitats are often the transition from public to private ownership, potential to extend quality salmonid habitat downstream.

Figure 18. **Stream Meanders Across Flood Terrace**

Figure 19. **Road and Terrace Straightens Stream and Restricts Meanders**



C. Alluvial Valleys

<u>Historic:</u>

- rich biological areas, wetlands with fish, amphibians, waterfowl, furbearers, elk;
- high water tables, hardwood-lined sidechannels and sloughs with some conifers, and;
- quality fish habitat, large trout associated with wood complexes and deep pools, off channel areas were refuge from high flows, droughts;
- all salmonid species are dependent on alluvial valley aquatic habitat and floodplains for some part of their freshwater phase;
- most affected by simplified alluvial valley habitat are coho salmon and large resident trout. variations in annual smolts produced can be related to the complexity of floodplains and offchannel habitat used by juvenile salmonids as refuge from high flows and drought and;
- in addition, floodplain/stream connections have much to do with the capability of these depostional areas to store nutrients plant and animal materials deposited on the floodplain

Current:

- stream channels straightened for agriculture and residential uses;.
- few large wood pieces, open stream channels with high width/depth ratios, elevated stream temperatures;
- simplified aquatic habitat, loss of pools, riffle-dominated, and;
- lack of quality fish habitat, few side channels.

Trends:

- few guidelines for agriculture use of floodplains and riparian areas;
- cooperative landowners will leave "belts" of riparian forest, but little improvement in overall floodplain function in tributaries or main river, and;
- large conifers and hardwoods will remain rare on floodplains, continued floodplain development and tapping of water table.

Fisheries:

- alluvial valley segments important spawning habitat for fall chinook, steelhead and coho salmon relegated to mainstem and large tributary valleys during drought years;
- lack of overwintering habitat off main channel will limit coho salmon production `and large trout, improvement will require private landowner cooperation, and;
- production potential for coho salmon, steelhead and trout will not be achieved without lower valley habitat restoration.

Figure 20. **Stream Meanders Across Wide Floodplain**

Figure 21. **Roads, Fields and Buildings Restrict Stream Movement**

Streamflow

Streamflow in the Applegate River Watershed mirrors the precipitation pattern, runoff lags about a month behind the precipitation. Approximately 80 percent of the annual precipitation falls in the months of November through April. About 80 percent of the runoff occurs from December through May. Runoff usually peaks in February through March. Historic extreme flood events, such as the 1964 and 1974 floods, have come in December and January as a result of rain-on-snow storm events.

For streams other than the mainstem of the Applegate River, which is augmented by releases from Applegate Lake, summer streamflows are naturally quite low and are exacerbated by irrigation withdrawals. The Applegate River watershed is crisscrossed by a network of irrigation systems. Many of these systems were constructed in the late 1800's and early 1900's to provide water for mining operations. Agricultural development followed with more ditch construction.

Drought

For much of the past decade, southwestern Oregon has experienced a drought. The dry conditions have severely stressed fish, other aquatic and wildlife populations, and trees and other vegetative components of the watershed. Many tributaries dried up completely in the summers of 1992 and 1994, stranding anadromous and resident fish in shrinking pools. Many of these fish eventually died.

Within the period of recorded streamflows, the Applegate River has dried up completely at times during the summer. The last such occurrence was in the summer of 1977 when the river had no flow at the Wilderville gaging station. Since the completion of the Applegate Dam and reservoir, releases of stored water have prevented the river from drying up completely. There is a guaranteed minimum streamflow at the mouth of the Applegate to assure that there will be water continuously in the river. Since completion of the dam, the minimum flow at Wilderville was 183 cfs.

The greatest need for water occurs during the summer when demand is high for irrigation, recreation, domestic use. This is also the time of lowest yield from the watershed. There is less water in the lower river than the upper in mid-summer. Withdrawal of water for irrigation is the primary reason for this. If it were not for water releases from Applegate Lake during this period of time, there would not be any water at the mouth of the Applegate River at times during the summer period.

Water Quality

Beneficial uses for the Applegate River are domestic water supply, irrigation, stock watering, coldwater fish and other aquatic life, wildlife, recreation, and aesthetics. There are currently no streams classified as water quality limited under the Clean Water Act. The 1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution (DEQ 1988) indicates that there are a number of water quality problems within the Applegate River Watershed. Table 09 lists streams with identified water quality problems and the beneficial uses affected.

Table 09. **Impacted Beneficial Uses**

Stream Name	domestic water supply	irrigat-ion	stock	cold water fish	other aquatic life	wildlife	water recrea-tion	aesth-etics
Applegate River (lower)	Y	Y	Y	Y	Y			Y
Applegate River (upper)				Y				Y
Little Applegate River (l)		Y	Y	Y	Y	Y	Y	Y
Little Applegate River (u)		Y	Y	Y	Y	Y	Y	
Beaver Creek				Y	Y			Y
Yale Creek				Y				
Star Gulch				Y				
Forest Creek			Y	Y	Y	Y		Y
Thompson Creek				Y	Y			Y
Nine Mile Creek				Y				
Williams Creek	Y	Y	Y	Y	Y			Y
Williams Creek, West Fork				Y				
Slate Creek	Y	Y	Y	Y	Y			Y

Y = impacted use.

<u>Stream Temperature</u>

Elevated stream temperatures continue to be a problem within the watershed. Low flows from drought and irrigation withdrawals reduce stream flows and increase water temperatures. Temperatures above 65 degrees F. jeopardize salmonid species and favor warm water fish. Logging, residential and agricultural clearing of riparian areas, and drought-caused mortality of conifers have removed the naturally-occurring riparian vegetation which shade the stream, further contributing to higher water temperatures.

Headwater streams are largely cool, with maximum temperatures in the 60's or lower during the summer. High temperatures occur occasionally in the forested headwater streams where shading streamside vegetation has been removed. Lower in the watershed temperatures tend to rise to a level

where they are detrimental to fish. Reasons for this increase in temperature are a general trend to wider, shallower channels; decreases in flow velocity; diversions to and return flows from ponds; and less shading riparian vegetation. Table 10 shows 7-day maximum stream temperatures throughout the watershed. Generally, stream temperatures are less than optimum in tributaries and are limiting or lethal for cold water fish in the mainstem of the river.

Elevated water temperatures and low flows will stimulate a number of diseases that can significantly affect fish. Dermosystidium and columnaris both have killed thousands of Applegate salmon in the past.

Table 10. **Seven-day average high stream temperatures** for selected streams in the Applegate River Watershed

STREAM	TEMP. (F°)	RATING
Middle Monogram Lake Spring	54.9°	Optimum
Box Canyon near mouth	55.8°	Optimum
Split Rock Creek @ mouth	56.7°	Optimum
Sterling Creek above Armstrong	59.0°	Optimum
Lick Gulch @ Road 39-2-28	59.3°	Optimum
Crapsey Gulch near mouth	59.9°	Optimum
Bear Gulch near mouth	60.6°	< Optimum
Dog Fork near mouth	61.4°	< Optimum
Upper McDonald Creek	62.1°	< Optimum
Greeley Creek near mouth	62.2°	< Optimum
Sturgis Fork near mouth	62.7°	< Optimum
Little Applegate River @ Bear Gulch.	62.9°	< Optimum
Butte Fork Applegate River	63.0°	< Optimum
Yale Creek near Kenney Meadows	63.1°	< Optimum
McDonald Creek near mouth	63.1°	< Optimum
Glade Creek near mouth	63.8°	< Optimum
Yale Creek near mouth	67.0°	< Optimum
Elliott Creek near mouth	67.3°	< Optimum
Little Applegate @ Tunnel Ridge	67.6°	< Optimum
Little Applegate above Glade Creek	68.0°	< Optimum
Little Applegate below Sterling Creek	70.8°	Limiting
Applegate River above Little	70.8°	Limiting
Little Applegate below Yale Creek	71.3°	Limiting
Little Applegate near mouth	75.6°	Mortality

Ratings: Optimum = < 60° F;
< Optimum = 60°-70° F
Limiting = 70°-75° F
Mortality = > 75° F

Sedimentation

Much of the Applegate River Watershed is characterized by highly dissected slopes and narrow, steep canyons. Granitic and serpentine rock types and soils are highly erodible, especially in this steep terrain. Logging and road building have caused extensive upland erosion, in some cases creating or exacerbating landslides, causing sedimentation of stream beds and consequent loss of spawning and rearing habitat. Amaranthus, et. al. (1985) found that erosion rates on roads were 100 times greater than those on undisturbed areas. Road density is a rough indication of potential risk for sedimentation in upland terrain. However, there are many types of streams where sediment is not a problem, e.g. where stream power exceeds the sediment input. Sediment problems are most likely in low gradient areas and those with granitic soils.

Figure 22. **Primary and Secondary Roads in the Applegate River Watershed.**

Improper grazing practices allowing livestock in riparian zones, over-grazing in general and residential clearing, in and outside of riparian zones, have also contributed to increased sedimentation. Landslides and bank erosion can occur as a result of natural forces, but are accelerated by vegetation removal, and steepening of slopes by road and ditch construction and seepage from ditches. Annual

maintenance of many diversion structures (especially push-up gravel dams) also causes sedimentation. Activities which could cause soil erosion problems should be avoided in these areas.

Sedimentation increases turbidity and increases embeddedness. The FEMAT report summarizes that "Increased levels of sedimentation often have adverse effects on fish habitats and riparian ecosystems. Fine sediment deposited in spawning gravels can reduce survival of eggs and developing alevins. Primary production, benthic invertebrate abundance, and thus, food availability for fish may be reduced as sediment levels increase. Social interaction and feeding can be disrupted by increased levels of suspended sediment. Pools and important habitat types may be lost due to increased levels of sediment. In general, the highest productivity and diversity of aquatic invertebrates seems to occur in riffle habitats with medium cobble and gravel substrate. Areas of shifting sands commonly have reduced species abundance and richness. Where excessive fines are washed into the streams a "mat" is formed on top of the coarser bed materials. The filling of gravels with finer sediments can reduce inter-gravel flow rates, suffocate eggs, limit burrowing activity and trap emerging young.

Possible Occurrences and Trends

Roads - Road construction associated with timber harvesting has changed the hydrology of the watershed. Most of the road construction has occurred in the steep headwater areas of the watershed. In many cases, there was inadequate planning for surface water drainage from the roads, erosion from the road surface, intercepted groundwater flow, stream crossings, etc. Roads have altered the timing of runoff from the watershed and have changed the volumes of water in the stream system. Many roads are poorly designed for passage of fish and for large event floods.

The trend in managing roads within the watershed will be to reduce the number of roads through closure or obliteration. Where roads are to be kept, there will be increased erosion control through surfacing or paving, enlarging culverts to provide for passage of larger flows during flood events, more relief culverts, better planning for fish passage.

Grazing - Cattle and sheep grazing has been a part of the environment of the watershed for over a century. In the late 19th. century, overgrazing of sheep in high mountain meadows denuded many sites of protective vegetation. High intensity rainstorms eroded raw soils leaving the meadows gullied and streams filled with sediment. Some of the sites continue to be problems today; McDonald Basin is one such site.

The trend for grazing on federal land is for fewer cows and reduced season of use on grazing in streamside areas and in wet meadows. Guidelines on utilization standards and more active control of the movement of cattle throughout the range allotments should provide for better protection of sensitive environments throughout the watershed. Where the increased controls are not effective in protecting other resources, removal of grazing will likely occur.

Areas damaged by grazing of domestic livestock will be identified for rehabilitation projects.

Fisheries

Historic and Current Fisheries Information

Streamside Vegetation-Higher Gradient Streams

Within the zone of seasonal inundation, a guild of perennial native sedges, rushes, wetland forbs, and some shrubs and trees, have adapted to frequent regular disturbance by normal high water flows and prolonged periods of inundation. As this zone dries out in the summer, annual forbs and grasses (native and non-native, and not necessarily wetland species) frequently appear among exposed rocks, sand, silt, and gravel.

The flood zone, above normal high flow levels, is perhaps the richest zone in terms of species diversity, vegetation structure, and age classes. Here, wetland and upland plants form a complex community. Periodic floods and landslides provide the disturbance needed to keep pioneer and early seral species and age classes. At the same time, good growing conditions (light, water, and sometimes alluvial soils) encourage high growth and vigor, mid-late seral species, and older age classes. Alders, maples, willows and conifers are typically present. The last appreciable flood occurred about 20 years ago; and there is a distinct class of young riparian trees, typically alders, in the flood zone.

Above the flood zone upland species are present. The stream's presence and slope position favor lower fire frequencies and intensities than in the surrounding upland area. Consequently, older coniferous forest is more likely to develop here than in the surrounding uplands.

Logging, road building, sometimes grazing, and fire suppression have altered the natural patterns of vegetation along many higher gradient streams.

Streamside Vegetation-Larger Lower Gradient Streams (except main stem of the Applegate river)

Many of the vegetation components and patterns are similar to the higher gradient streams. Some noteworthy differences are presented here.

Within the zone of seasonal inundation, plants are still subject to regular disturbance and prolonged inundation. However, they are often a different suite of species more suited to longer hotter drier summers and less shade. There may be proportionally more species adapted to shifting silt, sand, and gravel, and less that simply cling to crevices in rocks and between boulders. Annual grasses and forbs are more abundant than in higher gradient streams.

Within the flood zone, but above normal high flow levels, there are even more complex patterns of vegetation than in the flood zone on higher gradient streams, mainly because it is wider. Gentler terrain means less landslides, and less landslide influence on vegetation patterns. However, it also allows more channel shifts which tend to complicate vegetation patterns and obscure the "zones" described here. Oregon ash and cottonwood join the species mentioned for higher gradient streams.

Above the flood zone, soils are frequently alluvial and deep. Potentially, very large trees can grow here and probably did in the past. Because these streams are at low elevation, this zone is likely to contain more diversity of tree species than it would along higher gradient streams. Besides Douglas-fir, canopies are likely to contain oaks, madrones, and pines. Where these areas were regularly burned by Native Americans, open park-like plant communities may have been present.

Past and current human activity has drastically altered the vegetation in these riparian areas. Mining activity affected large portions of the seasonally inundated and flood zones. Logging in and above the flood zone has removed most of the big trees. Clearing land for agriculture has removed a significant amount of vegetation in the flood zone and most of the native vegetation above the flood zone. Livestock grazing exerts a big influence on species composition in all these zones. Non-native species are rampant in all these zones now, steadily crowding out native plant species.

Streamside Vegetation-Main Stem of the Applegate River Below Applegate Dam

Historic and current conditions are similar to those described for larger, lower gradient streams, with the following differences. The zone of seasonal inundation and flood zone were wider historically but restricted since completion of the Applegate Dam. Vegetation is expected to increasingly grow up in these zones. Flood zones will increasingly take on the characteristics of vegetation above the flood zone. Areas that were once flood zones have become attractive for agricultural and residential development, and are likely to be cleared. Non-native blackberries have already occupied much of the flood zone. They continue to increase and encroach on what was once the zone of seasonal inundation.

***Wetland Vegetation* (Other Than Streamside)**

Springs, seeps, bogs, lakeshores, fens, wet mountain slopes, and moist mountain meadows all have vegetation structure and composition that differs from surrounding uplands and even from other wetland types. Conditions range from pristine to highly altered. Moist mountain meadows were identified as a community at risk of extirpation in the EHA (pg. 33) and information about their condition is provided in that document.

Riparian Reserve

The Record of Decision (Northwest Forest Plan), ROD, establishes riparian reserves in the watershed on federal land. Vegetation characteristics and riparian processes affecting vegetation in these reserves is similar to what is described above for higher gradient streams. Specific summary information on forest tree species, cover, and structure within the reserves is currently available for the Palmer and Beaver Creek area and soon will be for the Little Applegate sub-drainage. That information is not summarized in this document because it is uncertain whether it is representative of riparian reserves in the rest of the watershed. That information may help the agencies determine how to meet the aquatic conservation strategy in the portions of the watershed where it was collected.

C. Special Plants, Plant Habitats, and Range

Current Conditions

EHA pages 17-25, provides good descriptions and current condition information for upland vegetation at a landscape and watershed scale. Specific topics added or expanded in this document are:

- non-native plants and noxious weeds;
- range condition and trend;
- rare plant species/communities including ROD Table C-3 cryptogams and fungi, and;
- Research Natural Areas, Areas of Critical Environmental Concern, Botanical Areas

Non-Native Species And Noxious Weeds

These alien species are a threat to indigenous plants and animals and native plant communities worldwide. The Applegate River Watershed is no exception. Half of the acres in the watershed probably have one or more non-native species firmly established. Half of the remainder probably have non-natives present in the soil seedbank, waiting for the next disturbance event to increase their presence.[1] A large portion of lower elevation open areas in the watershed have herbaceous vegetation layers completely dominated by these species. Non-native species invasion is the primary reason that native low-mid elevation grasslands were listed in the EHA as a community at risk of extirpation, and a major reason that moist mountain meadows and valley floor native plant communities were listed as such. The problem decreases with elevation and canopy coverage. The aliens use any kind of disturbance event to colonize and spread. Humans, machinery, animals, and wind are vectors. Livestock are common disturbance agents. A number of these species have been intentionally introduced as forage or erosion control plants. See Table 11 as an example of the extent to which non-native species are occupying the Applegate River Watershed.

[1]. Personal communication with Wayne Rolle (RRNF Botanist) and Joan Seevers (Medford BLM District Botanist).

Table 11. **Non-Native species in just one plant family, the grasses, that are widespread in the Applegate River Watershed.**

(present on 1,000 to 50,000 acres, each species).

Scientific Name	Common Name
Aira caryophylla	annual hairgrass
Agrostis tenuis	colonial bentgrass
Alopecurus pratensis	meadow foxtail
Arrenatherum eliatus	tall oatgrass
Avena fatua	wild oats
Bromus mollis	smooth brome or blando brome
Bromus rigidus	ripgut brome
Bromus tectorum	cheatgrass
Cynosurus echinata	dogtail grass
Dactylis glomeratus	orchard grass
Festuca aurundinacea	tall fescue or hard fescue
Holcus lanatus	velvet grass
Hordeum leporinum	foxtail barley
Phleum pratense	timothy
Poa pratensis	Kentucky bluegrass
Taeniatherum caput-medusae	medusa head
*Vulpia myuros (*and *V. megalura)*	rat-tail fescue or Zorro fescue

A number of aliens are officially listed as noxious weeds by the Oregon Department of Agriculture (Table 12.). Traditionally, these are plants that have clear negative economic impacts. Official noxious weeds are not necessarily the most damaging or threatening to wildland native plant communities.

Table 12 **Noxious weeds known to be present in the Applegate River Watershed**

Scientific Name	Common Name
Centaurea diffusa	diffuse knapweed
Centaurea maculosa	spotted knapweed
Centaurea solstitialis	yellow star-thistle
Cirsium vulgare	bull thistle
Conium maculatum	poison hemlock
Convulvulus arvensis	field bindweed
Cytisus scoparius	scotch broom
Hypericum perforatum	Klamath weed
Isatis tinctoria	dyer's woad
Senecio jacobaea	tansy ragwort
Taeniatherum caput-medusae	medusa head
Tribulus terrestris	puncture vine

Yellow star-thistle is generally acknowledged to be the current most serious noxious weed in the watershed. It is well established on many previously disturbed sites below 3000 ft., and is encroaching on other habitats as well.

Non-local stocks and cultivars of native plants may be a threat to local genetic diversity in native plant populations of the same species. Non-local stocks of the following native species may have been introduced into wildland portions of the watershed: California brome, red fescue, sheep fescue, sickle-keeled lupine, Kentucky bluegrass, and various conifers (list is cursory, not all may be true natives and no record of introduced stock is available). In agricultural and residential areas it is likely that a large number of non-local stocks and cultivars of native plants are present.

Range Condition And Trend

This discussion is brief. A more thorough description of range management in the watershed is merited. This discussion concerns the wildland portions of the watershed, not improved or irrigated pastureland.

A significant portion of the watershed is grazed by livestock, mostly cattle. Rangeland grazing occurs at:

- higher elevations on open mountain slopes and moist meadows;
- spring and early summer range on low-mid elevation dry grasslands, shrublands, grass/shrub/tree mosaics and open forestland;
- riparian areas (where access and forage are available) at all elevations, and;
- roadsides and transitory range (timber harvest units) at all elevations.

Except for roadsides and transitory range, these generalized plant communities are important elements of biological diversity within the more abundant matrix of forestland. Thus the ecological condition of these rangelands is important to any kind of ecological assessment of the watershed.

A long history of season-long grazing, every season, with little or no control on livestock movement, over-stocking and over-utilization has left much of the rangeland in unsatisfactory condition. Non-native plants capitalizing on livestock disturbance have helped degrade the rangeland condition. Range ecological condition (a rating that combines forage value, degree of departure from original vegetation, and soil condition) varies by location but is commonly poor. The trend in range ecological condition is generally stable or downward. Productivity (pounds of forage produced per acre) ranges from low to high but is definitely less than would be expected from rangeland in better ecological condition.

Rare Plant Communities

The EHA, pages 32-34 lists specific rare plant communities that are considered at risk of extirpation from the watershed.

Rare Plant Species

The rare plant species considered at highest risk of extirpation from the watershed are discussed in the EHA, pages 35-36. That information is expanded here to contain a more comprehensive listing of rare plant species in the watershed.

Table 13. **Rare Plant Species Known to Occur in the Applegate River Watershed**

Scientific Name	Common Name	Federal and State Status*	Local Risk**
Abies amabilis	Pacific Silver Fir	CNPS2	
Allium bolanderi	Bolander's Onion	ONHP3	
Allium campanulatum	Sierra Onion	ONHP4	High
Antennaria dimorpha	Low Everlasting		High
Arabis aculeolata (glabrous form)	Waldo Rockcress	CNPS2,ONHP4	High
Arabis koehleri var. *stipitata*	Koehler's Stipitate Rockcress	CNPS1,ONHP4	
Arabisx ultrapurpurascens	Red Buttes Rockcress		
Arnica viscosa	Shasta Arnica	CNPS4,ONHP2	High
Artemisia arbuscula	Scabland Sagebrush		
Artemesia tridentata	Big-Leaf Sagebrush		High
Astragalus umbraticus	Woodland Milk-Vetch	CNPS4,ONHP2	
Betula occidentalis	Water-Birch		High
Calochortus nudus	Shasta Star-Tulip	ONHP2	High
Camissonia graciliflora	Slender-Flowered Evening Primrose	ONHP3	
Cardamine nuttallii var. *gemmata*	Purple Toothwort	C2,CNPS1,ONHP1	
Carex gigas	Siskiyou Sedge	CNPS4,ONHP2	
Carex scirpoidea var. *pseudoscirpoidea*	Western Single-Spiked Sedge		High
Carex whitneyi	Whitney's Sedge	ONHP3	
Castilleja hispida ssp. *brevilobata*	Short-Leaved Paintbrush	CNPS4,ONHP3	
Castilleja schizotricha	Split-Hair Indian Paintbrush	CNPS4,ONHP2	
Cimicifuga elata	Tall Bugbane	ONHP1	High
Cupressus bakeri	Baker's Cypress	CNPS4,ONHP2	High
Cupressus nootkatensis	Alaska Cedar	CNPS4	High
Cypripedium californicum	California Lady's-Slipper	CNPS4,ONHP4	High
Cypripedium fasciculatum	Clustered Lady's-Slipper	CNPS4,ONHP1	High
Cypripedium montanum	Mountain Lady's-Slipper	CNPS4,ONHP4	High
Darlingtonia californica	California Pitcher Plant	CNPS4,ONHP4	
Dicentra formosa ssp. *oregana*	Oregon Bleeding Heart	CNPS4,ONHP4	

Table 13. **Rare Plant Species Known to Occur in the Applegate River Watershed (continued).**

Scientific Name	Common Name	Federal and State Status*	Local Risk**
Dicentra pauciflora	Few-Flower Bleeding Heart	ONHP2	
Dicentra uniflora	One-Flowered Dicentra		
Draba carnosula	Mt. Eddy Draba	C2,CNPS1	
Draba howellii	Howell's Whitlow-Grass	CNPS4,ONHP2	
Epilobium oreganum	Oregon Willow-Herb	C2,CNPS1,ONHP1	High
Epilobium rigidum	Rigid Willow-Herb	CNPS4,ONHP4	
Epilobium siskiyouense	Siskiyou Willow-Herb	C2,CNPS1,ONHP1	
Erigeron cervinus	Siskiyou Daisy	CNPS4,ONHP2	
Erigeron petrophilus	Cliff Daisy	ONHP2	
Eriogonum diclinum	Jaynes Canyon Buckwheat	CNPS4,ONHP2	
Eriogonum lobbii	Lobb's Buckwheat	ONHP2	High
Eriogonum pendulum	Nodding Buckwheat	CNPS2,ONHP4	
Eriogonum ternatum	Waldo Buckwheat	CNPS4,ONHP4	
Euonymus occidentalis	Western Wahoo	ONHP3	High
Fritillaria gentneri	Gentner's Fritillaria	C1,ONHP1	High
Fritillaria glauca	Siskiyou Fritillaria	ONHP2	
Gentiana newberryi	Newberry's Gentian	ONHP2	
Gentiana plurisetosa	Elegant Gentian	CNPS4,ONHP2	High
Gentianopsis simplex	One-Flowered Gentian		
Haplopappus whitneyi ssp. *discoideus*	Whitney's Haplopappus	ONHP2	
Hesperevax sparsiflora var. *brevifolia*	Short-Leaved Evax	ONHP3	
Hieracium bolanderi	Bolander Hawkweed	ONHP2	
Hieracium greenei	Greene's Hawkweed	ONHP3	
Hierochloe odorata	Vanilla Grass	CNPS2	High
Horkelia congesta ssp. *nemorosa*	Josephine Horkelia	CNPS2	
Horkelia hendersonii	Henderson's Horkelia	C2,CNPS1,ONHP1	
Isopyrum stipitatum	Dwarf Isopyrum	ONHP3	High
Keckiella lemmonii	Lemmon's Penstemon	ONHP3	
Juniperus occidentalis	Western Juniper		High
Lewisia cotyledon var. *howellii*	Howell's Lewisia	CNPS3,ONHP4	
Lewisia lLeana	Lee's Lewisia	ONHP2	
Limnanthes gracilis var. *gracilis*	Slender Meadow-Foam	ONHP1	High
Lithophragma campanulata (siskiyou form)	Large-Flowered Hill Star	ONHP3	High

Table 13. **Rare Plant Species Known to Occur in the Applegate River Watershed (continued).**

Scientific Name	Common Name	Federal and State Status*	Local Risk**
Lomatium engelmannii	Engelmann's Desert-Parsley	CNPS4,ONHP2	
Lonicera interrupta	Chaparral Honeysuckle	ONHP3	
Mertensia bella	Oregon Lungwort	CNPS2,ONHP3	
Microseris howellii	Howell's Microseris	C2,ONHP1	High
Mimulus bolanderi	Bolander's Monkeyflower	ONHP2	High
Mimulus douglasii	Douglas Monkeyflower	ONHP4	
Mimulus jepsonii	Jepson's Monkeyflower	ONHP2	
Mimulus kelloggii	Kellogg's Monkey-Flower	ONHP4	
Monotropa uniflora	Indian Pipe	CNPS2	
Pedicularis contorta	Curved-Beak Lousewort	CNPS4	High
Pedicularis howellii	Howell Lousewort	CNPS4,ONHP2	
Pellaea breweri	Brewer's Cliff-Brake		
Perideridia howellii	Howell's False-Caraway	ONHP2	
Pinus sabiniana	Digger Pine	ONHP3	
Pityopus californicus	California Pinefoot	CNPS4	
Plagiobothrys figuratus ssp. *corallicarpus*	Coral Seeded Allocarya	C2,ONHP1	High
Poa piperi	Piper's Bluegrass	CNPS4,ONHP2	
Polystichum lemmonii	Shasta Fern	ONHP4	
Polystichum lonchitis	Holly Fern	CNPS3	
Populus tremuloides	Quaking Aspen		High
Rhamnus crocea ssp. *ilicifolia*	Golden Buckthorn	ONHP2	High
Ribes marshallii	Marshall Gooseberry		
Rubus nivalis	Snow Bramble	CNPS2	High
Saussurea americana	American Sawwort	CNPS2	High
Saxifraga fragarioides	Strawberry-Leaved Saxifrage	ONHP2	
Scirpus pendulus (lineatus)	Drooping Bulrush	ONHP3	
Sedum divergens	Spreading Stonecrop	ONHP3	High
Sedum integrifolium	Rosy Sedum		High
Sedum laxum ssp. *heckneri*	Heckner's Stonecrop	CNPS4,ONHP2	
Sedum oblanceolatum	Applegate Stonecrop	C2,CNPS1,ONHP1	
Sedum radiatum ssp. *depauperatum*	Depauperate Stonecrop	C2,ONHP3	
Sedum spathulifolium ssp. *purdyi*	Purdy's Stonecrop	ONHP2	
Senecio hesperius	Western Senecio	C2,ONHP1	High

Table 13. **Rare Plant Species Known to Occur in the Applegate River Watershed (continued).**

Scientific Name	Common Name	Federal and State Status*	Local Risk**
Smilax californica	California Smilax	ONHP4	High
Suksdorfia ranunculifolia	Buttercup-Leaved Suksdorfia		
Swertia radiata (Frasera speciosa)	Giant Swertia		High
Tauschia glauca	Glaucous Tauschia	CNPS4	High
Tauschia howellii	Howell's Tauschia	C2,CNPS1,ONHP1	High
Tiarella trifoliata var. *unifoliata*	Trifoliate Laceflower	CNPS3	
Triteleia hendersonii var. *herderson*	Hernderson's Triteleia	CNPS2	
Veronica copelandii	Copeland's Speedwell	CNPS4	

* FEDERAL AND STATE STATUS column: Blanks in this column indicate species that are rare locally and tracked locally by federal agencies but have no federal or state status. Candidates for listing under the federal endangered species act are indicated by "C1" OR "C2". Species tracked by the California Native Plant Society are indicated by "CNPS [1,2,3,4]". Species tracked by the Oregon Natural Heritage Program are indicated by "ONHP [1,2,3,4]". These terms are explained below:

C1 = The US Fish and Wildlife Service has enough information to justify a proposal to list these species.
C2 = The US Fish and Wildlife Service does not yet have enough information to justify a proposal to list these species.
CNPS1 or ONHP1 = Species which CNPS or ONHP considers rare, threatened, or endangered throughout the it's range.
CNPS2 or ONHP2 = Species which CNPS or ONHP considers rare, threatened, or endangered within their respective states, but more common elsewhere.
CNPS3 or ONHP3 = Species which CNPS or ONHP are reviewing for inclusion on their lists.
CNPS4 or ONHP4 = Species which CNPS or ONHP considers rare but currently stable within their respective states.

**LOCAL RISK Column: "HIGH" in this column indicates species that are at high risk of extirpation from the Applegate watershed within the foreseeable future. Blanks in this column indicate lesser risk of local extirpation.

Table 13 includes only those species considered important enough to track by local federal agencies. It includes species with federal and state status as well as species that are important rare local elements of biological diversity but are more common outside our area. A few species with federal and state status on watch and review lists are not included when they appear to be locally abundant and secure. Non-vascular plants and fungi are not included.

There are 102 plant species considered rare within the watershed. Of those, 39 are considered at high risk of extirpation from the watershed in the foreseeable future. Of those, the species listed in the EHA have probably the highest priority for recovery. Brief narratives are provided in the EHA (pgs. 35-36) about each of those. No individual species information (habitats, threats, population numbers, etc.) is provided here.

Vascular And Non-Vascular Plants And Fungi **(ROD, Appendix J2)**
(also known as "survey and manage" species in the Northwest Forest Plan):

These species are associated with late-successional and old-growth forest within the range of the northern spotted owl. Four vascular plants in this category occur in the watershed.

Table 14. **Vascular Plants** (From ROD, Appendix J2) **that occur within the Applegate River Watershed**

	Scientific Name	Common Name
1	*Allotropa virgata*	sugarstick
2	*Cypripedium fasciculatum*	clustered lady-slipper orchid
3	*Cypripedium montanum*	mountain lady-slipper orchid
4	*Pedicularis howellii*	Howell's lousewort

The latter three are included in Table 13 with other rare plants. The Cypripediums are judged to have a high risk of extirpation. The lousewort is more secure. The Allotropa's distribution and abundance is not well documented in the watershed, although it has not previously been considered a rare plant in this area.

A far longer list of mosses, liverworts, lichens, and fungi from the ROD are potentially present in the watershed but documented occurrences are lacking. Federal agencies will not even be prepared to list those that are potentially present in the watershed until late 1995 or 1996. Consequently, risk of extirpation for any of these cannot yet be estimated.

Research Natural Areas (RNAs), Areas Of Critical Environmental Concern (ACEC), and Botanical Areas

These BLM and FS land allocations provide special protection or management for important elements of biological diversity. Usually each area has been designated for a particular plant community, group of rare species, or a particularly rich assemblage of native flora. There are 5 Research Natural areas, 1 Area of Critical Environmental Concern, and 12 botanical areas in the Applegate Adaptive Management Area..

D. Insects and Disease

Aquatic Insects

Numerous insects are adapted to aquatic life. Species in 10 insect orders spend at least parts of their lives in water. In most cases, immature stages are passed in water while adults live on land or in the air. There is great diversity among the aquatic insects, and they occupy a wide variety of aquatic habitats. Though many are superficially similar in appearance, there are a tremendous variety of individual species or species groups with unique adaptations for different ecological niches. The herbivorous insects play a key role as primary converters of plant material into animal protoplasm in aquatic systems. Both herbivores and predatory insects are extremely important as food for fish and other large animals.

In the Applegate River Watershed several points should be stressed concerning aquatic insects:

- Very different insect communities exist in ponds, large lakes, rivers, and streams, and very different insect populations occur in shallow littoral waters, bottom ooze, erosional lotic, depositional lotic, and lentic waters. To conserve diversity, all of the major habitat types in the ecosystem should be maintained.

- The most sensitive aquatic insects (and most of the insects considered to be rare in western Oregon, see Table 15) are those in the orders Plecoptera (stoneflies), Trichoptera (caddisflies), Ephemeroptera (mayflies), Megaloptera (hellgrammites, dobsonflies, and fishflies), and Diptera (nematocerous flies) that occupy cool lotic habitats and are the preferred foods of freshwater salmonids. Their survival and productivity are influenced by temperature, turbidity, bottom type, and detritus availability. Temperature has by far the most profound effect on these insects, both as a direct factor influencing physiological processes and as a limiting factor on dissolved oxygen. Temperatures above 65 degrees F (18 degrees C) are suboptimal and temperatures above 75 degrees F (24 degrees C) may be lethal. Cool temperatures are definitely favorable; some of these species exist close to the freezing point and many can grow at winter temperatures. Plecopterans, Trichopterans, Ephemeropterans, Megalopterans, and some Dipterans can be negatively impacted by the scouring action associated with elevated silt levels in turbid streams.

- Historical data on distribution and population levels of aquatic insects in the Applegate River Watershed are lacking. However, based on our knowledge of stream conditions and fish populations at the time of first European settlement, it seems certain that the insects of cool lotic habitats listed in the paragraph above were more plentiful than they are today. Though definitely still common in many streams throughout the watershed, insects in this group have probably declined as the result of increases in stream temperatures and siltation. These effects are likely greatest in the lower portions of the watershed. Monitoring aquatic insects is now a common practice in selected reaches of streams within the Watershed, so future trends should be better documented.

- Future occurrences and trends will definitely influence distribution and population levels of the Plecopterans, Trichopterans, Ephemeropterans, Megalopterans, and Dipterans of the cool lotic habitats in the Applegate River Watershed. These will also influence the populations of fish that are dependent on these insects for much of their food. Large scale reductions in insect populations can be expected where stream temperatures are significantly elevated as a result of loss of streamside vegetation, decreases in channel depths, decreases in water flow, and water diversions. Depending on the scale, large wildfires and major insect and disease-caused tree mortality events could contribute to increased stream temperatures by removing substantial amounts of stream cover. Human activities such as extensive regeneration harvests, agricultural and residential development along stream banks, and regulation of stream flow contribute to higher temperatures as well. Management activities can be designed to minimize negative effects on stream temperatures. Protection of streamside buffers by allocation can help to ensure desirable stream temperatures. However, if carefully done, partial cut timber harvest, thinning, or prescribed burning should be possible in some streamside stands while retaining cover for shading.

- Thinning treatments may be desirable in the many locations in the Applegate River Watershed where conifers in riparian stands are at high risk of insect infestation. It may also be desirable as part of a management plan to enhance development of large tree components in streamside stands. Riparian restoration projects that result in improved shading to formerly denuded streamsides, increased channel depth, and greater flow can have very favorable affects on populations of desired aquatic insects. Insects, unlike some other kinds of animals, can respond very rapidly to improved habitat.

Occurrences or activities that result in increased siltation will also negatively affect populations of Plecopterans, Trichopterans, Ephemeropterans, Megalopterans, and Dipterans in cool lotic habitats. Affects will be more localized than those associated with stream temperature increases. Road building, mining, grazing, and off-road vehicle use as well as erosion on burned or clear cut areas could contribute to undesirable increases in siltation. Planning to avoid or minimize siltation associated with management activities should be a high priority in the Watershed.

Table 15. **Rare insects of western Oregon**

☑	Burnell's False Water Penny Beetle
☑	Dennings Agapetus caddisfly
☑	Green Springs Mountain Farulan Caddisfly
☑	Schuh's Homoplectran Caddisfly
☑	O'Brien Rhyacophilan Caddisfly
☑	Siskiyou Caddisfly
	Franklin's Bumblebee

☑ indicates occupation of cool lotic habitats in aquatic systems.

Risk of Insect Infestation in Riparian Areas

Bark beetles (family Scolytidae) and flatheaded woodborers (family Buprestidae) have caused alarming amounts of tree mortality in the Applegate River Watershed in recent years. Primary insects involved have been mountain pine beetle (*Dendroctonus ponderosae*), western pine beetle (*D. brevicomis*), and engraver beetles (*Ips* spp.) on pines, flatheaded fir borer (*Melanophila drummondi*) and Douglas-fir beetle *(D. pseudotsugae*) on Douglas-fir, and fir engraver (*Scolytus ventralis*) on white fir. Bark beetles and woodborers preferentially infest and kill trees that are under some level of stress. They are most successful on trees that are weakened by disease, injury, drought, or competition for water in overstocked stands. The major predisposing factor for infestation in the Applegate River Watershed is the dense condition of stands over extensive areas. Unfortunately, conifers in riparian stands are being affected as well as trees in upslope situations.

Bark beetles and flatheaded borers were present in historic stands in the assessment area, and they killed some trees. However, numbers of trees infested were small compared to numbers being killed today. There were relatively few suitable hosts in historic stands since stocking levels were much lower. Stand density was kept down by frequent low-intensity fires. Eighty years of fire exclusion and the resultant increase in stocking of fire intolerant tree species has now made intertree competition a major factor in almost all stands in the ponderosa pine and Douglas-fir series and many of those in the white fir series in the Watershed. Now, almost every conifer is a suitable beetle host, and conditions are ideal for beetle population increases. Already, beetle activity in the most susceptible host types is beginning to have serious implications. There is great potential to completely lose the large ponderosa and sugar pine components of many stands in just the next few years and the future of all pines appears tenuous in many areas.

The Applegate Adaptive Management Area Ecosystem Health Assessment (EHA) suggested that basal area be used as a measure of stand density to determine risk of insect infestation. It was suggested that basal areas of 120 square feet per acre in upslope stands and 140 square feet per acre in riparian stands represented thresholds above which risk of beetle infestation increased dramatically. The EHA recommended that density reduction treatments, either mechanical or through use of prescribed fire be instituted in stands where density exceeded the suggested thresholds. A map (map 15 EHA) was presented that stratified risk and provided a tool for determining priority of treatments.

It is true that in the portions of riparian areas where trees are actually influenced by stream moisture, conifers can grow in slightly denser stands than on upslope sites. This is a relatively small advantage, however. When conifers are growing in riparian areas with stand basal areas of 250 to 460 square feet/acre (very common densities in the Applegate River Watershed now), they are at great risk and density reduction is in order if retaining them is at all important to management objectives. If we don't manage densities in both overstories and understories, the beetles will do it for us, and it's unlikely that they will select the trees that we would like them to.

Port-Orford Cedar

Port-Orford cedar (*Cupressus lawsoniana*) has a very limited natural range along the Pacific Coast from Coos Bay, Oregon, south to the Mad River near Arcata, California. It occurs in a number of plant community types, but its natural distribution appears to be limited by its need for substantial amounts of available moisture. It prefers sites with year-round water seepage and generally is found in mixed stands with other tree species. Port-Orford cedar occurs in the Applegate River Watershed mainly in riparian areas on BLM and private land in the Williams sub-basin.

Port-Orford cedar is affected by an introduced pathogen *Phytophthora lateralis*, cause of Port-Orford cedar root disease. The pathogen was first reported killing nursery stock around Seattle, Washington in 1923, and it appeared in the native range of Port-Orford cedar in 1952 in Oregon. Subsequently, it has spread throughout much of the area occupied by its host. It is present and causes considerable mortality in some of the Port-Orford cedar stands in the Applegate River Watershed. The origin of the pathogen is unknown, but it is believed to be an Asian species based on resistance exhibited by Asiatic *Cupressus* species.

P. Lateralis is an Oomycete belonging to the family Phythiaceae in the order Peronosporales. It is highly adapted for spread in water and soil and is also capable of surviving for considerable periods of time when conditions are unfavorable for spread and infection. Zoospores produced in sporangia are flagellate and very motile in surface or soil water. Zoospores are attracted by root exudates and will follow an increasing gradient of chemical concentration until they contact host root tissue, germinate, penetrate the root, and initiate infection. Zoospore production is favored by mild, moist conditions and is optimal at temperatures between 10 and 20 degrees C (55 to 77 degrees F). When unfavorable warm, dry conditions prevail, *P. lateralis* forms thick-walled resistant chlamydospores. These resting spores are incapable of direct movement themselves, but their structure provides protection during passive movement in mud, soil, or infected roots. When environmental conditions become favorable again, chlamydospores germinate, forming zoospore-containing sporangia. Oospores (the spore stage produced by sexual union) also act as resting spores and may be transported in infected root tissues.

After infection, mycelia of *P. lateralis* grow in the host cambium until the entire root system is colonized and the tree dies. This may require up to 4 years in large trees. Small trees may be killed in a few weeks. The fungus lives vegetatively in the host as long as the tree survives.

In virtually all cases, infection of Port-Orford cedar by *P. lateralis* occurs in areas where obvious avenues for water-borne spore dispersal exist. Infection is highly dependent on presence of free water in the immediate vicinity of susceptible tree roots. High risk areas for infection are stream courses, drainages, or low lying areas downslope from already-present infection centers or below roads and trails where new inoculum is introduced. Port-Orford cedar is a prolific seed producer, and new regeneration of the species often becomes established in high risk areas where trees have been killed in the past. This regeneration usually becomes infected in turn, resulting in chronic disease expression in such places. Though tree to tree spread of *P. lateralis* via mycelial growth across root contacts does occur, it appears to happen infrequently in the field and is of little significance in the epidemiology of the disease. Zoospore spread in free water is much more important.

Humans have been the main vectors of Port-Orford cedar root disease. Long distance spread has resulted from moving infected seedlings and, especially, infested soil into disease-free sites. Major spread of the disease has occurred through earth movement in road construction, road maintenance, logging, and traffic flow on forest roads. In general, the disease has not spread into areas where physical barriers or lack of access has prevented human activity, especially during wet periods. Movement of the pathogen in soil clinging to the feet of cattle and elk is known to occur and has resulted in new infestations in a few instances.

Once brought into a new area, *P. lateralis* spreads in water downslope from roads and trails. Spread rates are quite variable, but can be great in favorable wet years. Topography has a considerable influence on spread. Steep slopes dissected by drainages quickly channel zoospore-infested water into streams. Cross slope spread is restricted. On broad slopes or flat areas, infested water may spread out over larger areas and move more slowly. Concave areas with Port-Orford cedar are very vulnerable to damage because they are easily flooded. Convex slopes have very limited vulnerability.

There has been concern that Port-Orford cedar root disease threatens its host with extinction. This is almost certainly not true because of Port-Orford cedar's ability to produce large quantities of seed at a young age and because many stands by virtue of their location have a high probability of escaping disease introduction. Nonetheless, the disease can cause truly impressive amounts of mortality and can greatly affect some stand components, especially the large Port-Orford cedar component, on affected sites.

In the Applegate River Watershed, Port-Orford cedar stands that are not yet affected by *P. lateralis* should be protected by excluding the pathogen. Exclusion may involve road closures, timing access to sensitive areas during dry weather, washing equipment that is being moved from infested to uninfested areas, removing Port-Orford cedars from buffers along roads where introductions are likely to occur, and featuring Port-Orford cedars on sites unfavorable for the pathogen (upslope situations, convex slopes, well-drained microsites). Inventories of Port-Orford cedar occurrence and location of infested and undiseased sites will be necessary to plan an effective management program.

E. Wildlife

Historic Conditions

Processes and functions that influence wildlife species and their habitats are attributes of ecology that continue to change and evolve at varying rates through time. The appearance of Native Americans in the watershed and their land use practices of burning probably benefited their preferred game species of birds and mammals on the valley floor and in low elevation oak woodlands and conifer forests. Native Americans established settlements of limited size and intensity. They used natural processes such as fire to manipulate the land to produce products that they needed and. Dispersed settlement and seasonal migration of communities probably minimized disturbance effects to most species.

The types of processes, rates of change, and the intensity of those changes on wildlife habitats increased dramatically with settlement of the watershed by Euro/Asian settlers. The activities introduced by this second group of human settlers mimicked natural processes less and impacted greater land areas and more habitat types. Burning practices were often not focused on improving the habitat quality for game animals but on exposing land forms for their mineral potential or for increasing the amount of grazing land available for sheep and cattle. Game animals and fur bearers were hunted and trapped not only for subsistence, but as marketable products to be exported outside the watershed. Large predators such as grizzly bear, wolf and mountain lion were extensively hunted in order to eliminate their conflicts with human endeavors. Hydraulic mining changed soil composition and landforms, creating different habitat capabilities than naturally occurred. Placer mining in creeks altered channels and their associated vegetation, disrupting habitat connectivity. Except for farming, the processes introduced by the early Euro/settlers are not, for the most part, still continuing today, but current conditions of wildlife species and their habitats have been largely shaped by these practices.

Subtle changes in socio-economic values after the turn of the century led to changing activities upon the landscape and different effects on wildlife species viability, dispersal and migration. Wildfire suppression as an agency and public priority took root in the 1920's, supplanting the natural role of fire in the watershed and limiting and degrading many habitat components important to wildlife. Before fire suppression began, occasional intense fires and frequent small fires left many canopy gaps, and understory habitat was generally more open. High contrast edges between early and late seral stages were probably not common; A mosaic of habitat stages was likely the rule. Species that did well in this regime included, northern spotted owl, American martin, and red tree vole. Species benefiting from the denser stands caused by fire suppression include, California quail, black-capped chickadee, and mountain beaver.

By the 1920's many private lands had already been logged to some degree, and the federal lands began their important role of providing lumber to local mills. This increase in both numbers of acres harvested, location of harvest units (north and east aspect slopes), and the intensity of the harvest (clear cut vs. select cut) began fragmenting late successional forest vegetation and influencing dispersal and migration of many species. Roads were built into the forest to access timber harvest areas and to facilitate fire suppression. This resulted in greater impacts to wildlife from direct human disturbance

and habitat fragmentation. More people moving into the valley has led to the settlement of valley bottom land and low-elevation oak woodland and conifer forests. This settlement pattern has eliminated or substantially altered much of the habitat used for home territories, wintering grounds and avenues for dispersal and migration by wildlife species such as elk, river otter and red-legged frogs. Settlement continues today and directly affects the current conditions of wildlife habitats found in the watershed, this pattern is expected to continue.

Current Conditions

The EHA described plant species and communities considered to be at risk. Within these plant communities are associated assemblages of wildlife species that could be expected to be in decline as well, e.g., low-mid elevation dry grasslands (Roosevelt elk, western bluebird, acorn woodpecker): valley bottom late-seral communities (northern spotted owl, pine marten, pileated woodpecker): moist mountain meadow (mountain bluebird, savannah sparrow, long-eared owl).. Individual species may not be considered to be at risk but the complex associations that these species have with each other and their habitat have been and continue to be altered and modified by our activities.

Human activities that affect natural processes within the watershed are of two main types. The first type includes farming, grazing and rural development in valley bottoms, riparian zones and low elevation woodlands and forests. The second type of human activity in the watershed is past and future forest management on public and private forest lands. For wildlife species and communities within the watershed, these are the human activities that have and continue to have the greatest impacts. These activities affect wildlife species and wildlife community occurrence, stability, dispersal and migration. Both types of activities have influenced habitat quality, connectivity, and fragmentation.

The functional condition of riparian areas as not only dispersal and migration pathways but also suitable habitat for many of the watershed's indigenous species (fisher, western pond turtle, bald eagle) has been negatively impacted, especially in the valley bottoms. Stream and river flows and channels have changed, riparian vegetation has been altered by clearing of the land or introduction of non-native species (domestic cats, opossums), and private homes interrupt the natural processes that once occurred in these productive riparian areas. These areas no longer contribute to species viability to the same degree that they once did, and for some species, the impacts are great.

Human settlement is also affecting processes in low elevational forests. Oak woodlands and open ponderosa pine stands have been the most heavily impacted from our settlement practices. Homes dot this area in much of the watershed, influencing the amount and quality of habitat for native species. Disturbance created by humans and their domestic animals, cutting of snags in forested areas, fire suppression, and the water needs of local residences all negatively impact the natural connectivity. In addition, these altered communities no longer support the same assemblages of species (acorn woodpecker, flammulated owl) as they did prior to development.

Changes introduced by settlement and our forest practices have impacted the quantity and quality of habitat in low elevation forests. Many of the large open grown oak trees are being replaced by those grown in more crowded conditions, limiting their canopy development and limb structure and size. Within these oak communities, cavities in living and dead oaks of sufficient size are needed for many species as nests, dens and roosts. The loss of these "savannah" type oaks will continue to contribute to the decline of many species.

Ponderosa pine and sugar pine are being lost in the watershed at an alarming rate. The loss of pine is due to both bark beetle infestation and encroachment of shrub and other conifer species as a result of fire suppression. Loss of pine stands, lack of replacement stands, and mortality salvage threaten existing and future supplies of high quality snag habitat. Pine stands in their natural condition were relatively open with a variety of grasses & forbs available as wildlife forage. Living, large pine trees provide food and shelter, and as snags, large pine trees continue to provide nest sites required by cavity dependent species as well as maternity and roost sites for bats. In the short term the abundance of snags resulting from the current high levels of pine mortality will benefit wildlife species dependent on them. In the longer term, these stands must be replaced & future habitat may be diminished.

Management practices previously used by federal agencies and private landowners on upland forested stands have modified habitat suitability for many species. Harvest types and methods, young stand improvement projects, road construction, fire suppression, prescribed fire, insect and disease management, salvage and special forest product collection all have had and will continue to have effects on the processes of genetic diversity and species viability.

Concern has been expressed over the connectivity and fragmentation of late-successional forest within the watershed. The recent FEMAT report and the Northwest Forest Plan and its ROD address late-successional forest habitat within the range of the Northern Spotted Owl. The Northwest Forest Plan established Late Successional Reserves to insure the future of large blocks of late-successional habitat. Management activities that occur in LSRs would be those that promote and or maintain the late successional characteristics of the forest.

In addition to providing blocks of late successional forests within watersheds, the Northwest Forest Plan addressed dispersal and migration for wildlife species dependent on late successional forests with a goal of maintaining 15% of each watershed in late successional forest, riparian buffers, and 100 acre reserves established around known spotted owl sites. The intent of the first two goals is to allow dispersal and migration of less mobile species within and between watersheds. Within the Applegate watershed the amount of late successional forest within the 9 sub-watersheds is shown in Tables 16-24.

Table 16. **Little Applegate River**

Vegetation Classification	Acres
Early Seral/Open Canopy	14,164
Young/Mid Seral Closed Canopy	13,160
Late Successional/Mature Closed Canopy	19,486
Hardwood Stands	519
Brush Fields	6,808
Grass/Meadows	2,261
Rock/Sparse Veg/Low Site	6,880
Total Acres Classified	63,279
Total Acres	72,243

Table 17. **Upper Applegate River**

Vegetation Classification	Acres
Early Seral/Open Canopy	29,119
Young/Mid Seral Closed Canopy	45,699
Late Successional/Mature Closed Canopy	46,776
Hardwood Stands	0
Brush Fields	17,344
Grass/Meadows	732
Rock/Sparse Veg/Low Site	2,500
Total Acres Classified	142,170
Total Acres	142,171

Table 18. **Thompson Creek**

Vegetation Classification	Acres
Early Seral/Open Canopy	3,970
Young/Mid Seral Closed Canopy	2,264
Late Successional/Mature Closed Canopy	7,256
Hardwood Stands	113
Brush Fields	368
Grass/Meadows	33
Rock/Sparse Veg/Low Site	1,521
Total Acres Classified	15,526
Total Acres	20,029

Table 19. **Star/Beaver/Palmer**

Vegetation Classification	Acres
Early Seral/Open Canopy	11,527
Young/Mid Seral Closed Canopy	14,871
Late Successional/Mature Closed Canopy	13,493
Hardwood Stands	71
Brush Fields	7,579
Grass/Meadows	1,694
Rock/Sparse Veg/Low Site	2,665
Total Acres Classified	51,899
Total Acres	52,244

Table 20. **Forest Creek**

Vegetation Classification	Acres
Early Seral/Open Canopy	4,961
Young/Mid Seral Closed Canopy	209
Late Successional/Mature Closed Canopy	2,693
Hardwood Stands	371
Brush Fields	533
Grass/Meadows	532
Rock/Sparse Veg/Low Site	1,714
Total Acres Classified	11,012
Total Acres	22,529

Table 21. **Middle Applegate River**

Vegetation Classification	Acres
Early Seral/Open Canopy	7,475
Young/Mid Seral Closed Canopy	293
Late Successional/Mature Closed Canopy	6,695
Hardwood Stands	1,384
Brush Fields	2,088
Grass/Meadows	665
Rock/Sparse Veg/Low Site	5,099
Total Acres Classified	23,699
Total Acres	41,038

Table 22. **Lower Applegate River**

Vegetation Classification	Acres
Early Seral/Open Canopy	9,521
Young/Mid Seral Closed Canopy	65
Late Successional/Mature Closed Canopy	9,607
Hardwood Stands	192
Brush Fields	211
Grass/Meadows	1,534
Rock/Sparse Veg/Low Site	1,674
Total Acres Classified	22,805
Total Acres	62,162

Table 23. **Slate Creek**

Vegetation Classification	Acres
Early Seral/Open Canopy	4,907
Young/Mid Seral Closed Canopy	7,597
Late Successional/Mature Closed Canopy	6,983
Hardwood Stands	0
Brush Fields	790
Grass/Meadows	108
Rock/Sparse Veg/Low Site	20
Total Acres Classified	20,404
Total Acres	28,399

Table 24. **Williams Creek**

Vegetation Classification	Acres
Early Seral/Open Canopy	12,849
Young/Mid Seral Closed Canopy	809
Late Successional/Mature Closed Canopy	13,413
Hardwood Stands	174
Brush Fields	181
Grass/Meadows	440
Rock/Sparse Veg/Low Site	212
Total Acres Classified	28,077
Total Acres	51,914

Given current data, it cannot be determined if the riparian zones are functioning adequately for species dispersal and migration. Many acres have been managed for timber production in the past and do not now contain the species, structures, and canopies necessary for species such as the tailed frog or hermit warbler. Additional negative impacts to the habitat in some of these areas may occur in streams paralleled by roads, inadequate culverts at stream crossings, and grazing. Site specific analysis at the subwatershed or drainage level will be needed to assess the functional capability of the riparian zones as wildlife habitat.

Fire suppression has altered other forest wildlife habitat besides oak woodlands and ponderosa pine forests. In Douglas-fir and white fir plant series, relative stand densities are higher over a greater number of acres than would be expected if the natural fire frequency had occurred. Young and mature forests in this condition will take longer to attain the structure and composition of late successional forests.

These stands, however, do provide habitat for a wide variety of species. Baseline monitoring was begun in the Williams Creek subwatershed in 1994 for neotropical migrants by Dr. Stuart Janes of SOSC. Initial data found that stands on north-facing slopes with basal areas of 190 to 220 square feet/acre provided habitat suitable for densities of some breeding birds similar to those levels found in late-successional forests. Stands on south-facing slopes in the same area with basal areas of 190 to 225 square feet/acre contained bird populations at 55% less than the north-facing slopes. This initial work displays the variation within the watershed.

Across the watershed, one habitat component has been impacted on both upslope and riparian habitats, and on public and private land by a variety of management and human activities. Snags and down logs provide essential habitat for many special status species (Table 25) located within the watershed, and snags and down logs contribute to the viability of many other species. The number of snags and down logs, their decay class and their distribution in the watershed is one of the important components of overall ecosystem health. Most of the bird and all of the bat species utilizing snags are insectivorous and provide natural regulation of insect populations. Many studies have examined the role of animals in controlling insects but few have compared their success at reducing impacts where suitable nesting and roosting habitat does not allow for their populations to increase in a response to increases in forage (insects).

Historically, on either public or private lands, there has not been a process for effective inventory of snag and down log numbers or their use by wildlife species. Until recently, snag and down log management polices in both federal agencies have addressed those snags needed by primary cavity excavators, such as woodpeckers. Little research of the requirements of other snag dependent and using species and how these species interact as communities has been done.

Extensive data is not available for current condition of snag levels across the watershed. Table 1 (Appendix 1) of the EHA displays snag distributions in established ecology plots. Past logging practices in federal agencies has left many managed stands deficit in the number of snags needed to support viable populations of primary cavity excavators. Removal of snags for safety purposes and especially for mortality salvage has impacted plant series and seral stages across the watershed. Positive benefits of the recent creation of snags due to drought stress should modify past negative effects to some degree, but these benefits are not distributed spatially or temporally throughout the watershed. However snags may not have been distributed spatially or temporally under natural conditions. Effective snag management must consider the spatial arrangement, size, decay stage and species of the snag as well as overall numbers. Sub-watersheds should be further inventoried to consider all species and snag attributes before current conditions can be adequately displayed.

Many indigenous wildlife species occurring within the Applegate watershed are considered to be at risk in at least portions of their natural ranges. Those species of immediate concern are considered to be threatened or endangered and those species being considered for listing as threatened or endangered (candidates). In addition are species that warrant special consideration based on information available from the Oregon Department of Fish and Wildlife. These species are listed in Table 26 as well as their occurrence in the watershed, survey levels conducted, vegetative condition and habitats used within the Applegate watershed.

Many of these special status species may not currently be considered to be at risk of extirpation within the watershed but their overall importance to species viability, dispersal and migration needs to be considered. Many of these species require special habitat features that need to be located, surveyed and managed for within the watershed. Special habitat features needed by many of these species were discussed in the first EHA.

Since the arrival of humans in the Applegate watershed, there have been impacts and effects to the habitat's ability to function as home range, dispersal and migration pathways for native wildlife species. To varying degrees, both Native American and European settlers impacted natural processes and their associated functions, by using plant and wildlife communities for products that they needed. The results of past activities have influenced the natural range of conditions. Human-introduced processes must be considered when analyzing the ability of the watershed to accommodate the range of natural process and functions within the watershed, if indigenous species viability is to be assured.

Special Status Species

Special status species are animals recognized by the federal or state government as needing particular consideration in the planning process, due to low populations (natural and unnatural), restricted range, threats to habitat and for a variety of other reason. Tables 25 and 26 list the known and potential special status species found in the watershed, along with legal status and level of survey to date. This list includes species officially listed, proposed for listing and candidate species being reviewed by the US Fish and Wildlife Service. State Listed Species are those species identified as threatened, endangered, or pursuant to ORS 496.004, ORS 498.026, or ORS 546.040.

Table 25. **Applegate River Watershed Special Status Species**

Common Name	Scientific Name	Presence	Status	Survey Level
Gray Wolf	*Canis lupus*	Absent	FE,SE	None To Date
White-Footed Vole	*Aborimus albipes*	Unknown	FC,SP	None To Date
California Red Tree Vole	*Aborimus pomo*	Suspected	FC	None To Date
Fisher	*Martes pennanti*	Present	FC,SC	Limited Surveys
California Wolverine	*Gulo gulo luteus*	Suspected	FC,ST	Limited Surveys
American Marten	*Martes americana*	Present	SC	Limited Surveys
Ringtail	*Bassacriscus astutus*	Present	SU	Limited Surveys
Townsends Big-Eared Bat	*Plecotous townsendii*	Present	FC,SC	Limited Surveys
Fringed Myotis	*Myotis thysanodes*	Present	FC,SV	Limited Surveys
Yuma Myotis	*Myotis yumanensis*	Present	FC	Limited Surveys
Long-Eared Myotis	*Myotis evotis*	Present	FC	Limited Surveys
Long-Legged Myotis	*Myotis volans*	Present	FC	Limited Surveys
Pacific Pallid Bat	*Antrozous pallidus*	Present	SC	Limited Surveys
Peregrine Falcon	*Falco peregrinus*	Present	FE,ST	Limited Surveys
Bald Eagle	*Haliaeetus leucocephalus*	Present	FT,ST	Limited Surveys
Northern Spotted Owl	*Strix occidentlis*	Present	FT,ST	Extensive Surveys
Marbled Murrelet	*Brachyramphus marmoratus*	Unlikely	FE,SC	Limited Surveys
Northern Goshawk	*Accipiter gentilis*	Present	FC,SC	Limited Surveys
Mountain Quail	*Oreortyx pictus*	Present	FC	ODFW Surveys
Pileated Woodpecker	*Dryocopus pileatus*	Present	SC	Incidental
Lewis' Woodpecker	*Melanerpes lewis*	Present	SC	Incidental

Table 25. **Applegate Watershed Special Status Species (continued)**

Common Name	Scientific Name	Presence	Status	Survey Level
White-Headed Woodpecker	*Picoides albolarvatus*	Suspected	SC	None To Date
Flammulated Owl	*Otus flammeolus*	Present	SC	Incidental
Purple Martin	*Progne subis*	Unknown	SC	None To Date
Great Gray Owl	*Strix nebulosa*	Present	SV	Limited Surveys
Western Bluebird	*Sialia mexicana*	Present	SV	None To Date
Acorn Woodpecker	*Melanerpes formicivorus*	Present	SU	Incidental
Tricolored Blackbird	*Agelaius tricolor*	Unknown	FC,S	None To Date
Pygmy Nuthatch	*Sitta pygmaea*	Suspected		None To Date
Black-Backed Woodpecker	*Picoides arcticus*	Suspected		None To Date
Northern Pygmy Owl	*Glaucidium gnoma*	Present	SU	Incidental
Grasshopper Sparrow	*Ammodramus savannarum*	Unknown	S	None To Date
Bank Swallow	*Riparia Riparia*	Migratory	SU	None To Date
Western Pond Turtle	*Clemmys sarmorata*	Present	FC,SC	Limited Surveys
Foothills Yellow-Legged Frog	*Rana boylii*	Present	FC,SU	Limited Surveys
Red-Legged Frog	*Rana aurora*	Suspected	FC,SU	Limited Surveys
Tailed Frog	*Ascaphus truei*	Present	SV	Limited Surveys
Del Norte Salamander	*Plethodon elongatus*	Present	FC,SV	Limited Surveys
Siskiyou Mtn Salamander	*Plethodon stormi*	Present	FC,SV	Limited Surveys
Clouded Salamander	*Aneides ferreus*	Present	SC	Limited Surveys
Southern Torrent Salamander (Variegated Salamander)	*Rhyacotriton variegatus*	Present	FC,S	Limited Surveys
Black Salamander	*Aneides flavipunctatus*	Present	SP	Limited Surveys

Status Abbreviations:

FE--Federal Endangered
FT--Federal Threatened
FP--Federal Proposed
FC--Federal Candidate
SE--State Endangered
ST--State Threatened

SC--ODFW Critical
SV--ODFW Vulnerable
SP--ODFW Peripheral or Naturally Rare
SU--ODFW Undetermined
BS--Bureau Sensitive
AS--Assessment Species (BLM)

Table 26. **Applegate River Watershed Habitat of Special Status Species**

Species (Common Name)	Habitat Association	Special Habitat Feature	Concern
Gray Wolf	Generalist	Large Blocks Of Unroaded Habitat	Extirpated
White-Footed Vole	Riparian	Alder/Mature Riparian	Naturally Rare, Modification/Loss of Habitat from Development
California Red Tree Vole	Mature/Old Growth Conifer	Mature Douglas-fir Trees	Declining Habitat Quality/Quantity from Logging
Fisher	Mature/Old Growth Riparian	Down Wood/Snags	Declining Habitat Quality/Quantity & Fragmentation From Logging
California Wolverine	Generalist	Large Blocks Of Unroaded Habitat	Declining Habitat Quality/Quantity & Fragmentation from Logging and Road Building, Human Disturbance
American Martin	Mature/Old Growth	Down Wood, Living Ground Cover	Declining Habitat Quality/Quantity & Fragmentation
Ringtail	Generalist	Rocky Terrain, Caves, Mine Adits	Northern Limit Of Range
Townsends Big-Eared Bat	Generalist	Mine Adits, Caves, Bridges	Disturbance to Nurseries, Hibernacula & Roosts, Closing Mine Adits
Fringed Myotis	Generalist	Rock Crevices & Snags	Disturbance to Roosts and Colonies
Yuma Myotis	Generalist	Large Live Trees With Crevices In The Bark &	Limited Mature Tree Recruitment
Long-Eared Myotis	Generalist	Large Live Trees With Crevices in the Bark	Limited Mature Tree Recruitment
Long-Legged Myotis	Genralist	Large Live Trees With Crevices in the Bark	Limited Mature Tree Recruitment
Pacific Pallid Bat	Generalist	Snags, Rock Crevices	General Rarity/Disturbance/Snag Loss
Peregrine Falcon	Generalist	Cliff Faces	Low Numbers, Prey Species Contaminated with Pesticides
Bald Eagle	Lacustrine/Rivers	Large Mature Trees With Large Limbs Near Water	Populations Increasing
Northern Spotted Owl	Mature/Old Growth	Late Successional Mature w/ Structure	Declining Habitat Quality/Quantity & Fragmentation

Table 26. **Applegate Watershed Special Status Species (continued)**

Species (Common Name)	Habitat Association	Special Habitat Feature	Concern
Marbled Murrelet	Mature/Old Growth	Large Limbed Trees, High Canopy Closure	Declining Habitat Quality/Quantity. Habitat potential slight in Applegate (maximum 50 miles from ocean)
Northern Goshawk	Mature/Old Growth	High Canopy Closure Forest for Nest Sites	Declining Habitat Quality/Quantity & Fragmentation, Human Disturbance
Mountain Quail	Generalist	Brush Fields	No Concern in the Watershed
Pileated Woodpecker	Large Trees	Large Diameter Snags	Snag and Down Log Removal from Logging, Salvage & Site Prep
Lewis' Woodpecker	Pine/Oak Woodlands	Large Oaks, Pines & Cottonwoods Adjacent To Openings	Declining Habitat Quality/Quantity Fire Suppression, Rural & Agriculture Development, Riparian Modification
White-Headed Woodpecker	Pine/Fir Mountain Forests	Large Pines Living and Dead	Limited Natural Populations, Logging of Large Pines and Snags
Flammulated Owl	Pine/Oak Woodlands	Pine Stands & Snags	Conversion of Mixed-Aged Forest to Even-Aged Forests
Purple Martin	Generalist	Snags in Burns with Excavated Cavities	Salvage Logging After Fire and Fire Suppression
Great Gray Owl	Pine/Oak/True Fir/Mixed Conifer	Mature Forest With Adjoining Meadows	Declining Quality/Quantity of Nesting And Roosting Habitat
Western Bluebird	Meadows/ Open Areas	Snags in Open Areas	Snag Loss/Fire Suppression Competition with Starlings for Nest Sites
Acorn Woodpecker	Oak Woodlands	Large Oaks	Declining Habitat Quality/Quantity
Tricolored Blackbird	Riparian	Wetlands, Cattail Marshes	Limited & Dispersed Populations, Habitat Loss from Development
Pygmy Nuthatch	Pine Forests	Large Dead & Decaying Pine	Timber Harvest of Mature Trees, Salvage Logging
Black-Backed Woodpecker	Pine	Snags And Pine	Removal of Mature Insect Infested Trees. Naturally rare.
Williamsons Sapsucker	Montane Conifer Forest	Trees with Advanced Wood Decay	Removal of Heartrot Trees, Snag Removal, Conversion to Managed Stand. Naturally rare.
Northern Pygmy Owl	Mixed Conifer/	Snags	Snag Removal, Depend on Woodpecker Species to Excavate Nest Cavities
Grasshopper Sparrow	Open Savannah	Grasslands with Limited Shrubs	Limited Habitat, Fire Suppression, Conversion to Agriculture

Table 26. **Applegate Watershed Special Status Species (continued)**

Species (Common Name)	Habitat Association	Special Habitat Feature	Concern
Bank Swallow	Riparian	Sand Banks Near Open Ground or Water	General Rarity, Declining Habitat Quality
Western Pond Turtle	Riparian/Uplands	Marshes, Sloughs Ponds	Alteration Of Aquatic and Terrestrial Nesting Habitat, Exotic Species Introduction
Del Norte Salamander	Mature/Old Growth	Talus	Declining Habitat Quality/Quantity & Fragmentation
Siskiyou Mtn. Salamander	Closed Canopy Forest	Talus	Declining Habitat Quality/Quantity & Fragmentation
Foothills Yellow-Legged Frog	Riparian	Permanent Streams with Gravel Bottoms	Water Diversions, Impoundments, General Declines in Genus Numbers
Red-Legged Frog	Riparian	Marshes, Ponds & Streams with Limited Flow	Exotic Species Introduction Loss of Habitat from Development
Tailed Frog	Riparian	Cold Fast Flowing Streams in Wooded Area	Sedimentation And Removal of Riparian Vegetation Due to Logging, Grazing & Road Building
Clouded Salamander	Mature	Snags & Down Logs	Loss of Large Decaying Wood Due to Timber Harvest and Habitat Fragmentation
Southern Torrent Salamander	Riparian	Cold, Clear Seeps & Springs	Water Diversions & Sedimentation From Roads & Logging
Black Salamander	Generalist	Down Logs, Talus	Limited Range, Lack of Data
Sharptail Snake	Valley Bottoms Low Elevation	Moist Rotting Logs	Low Elevation Agricultural and Development Projects That Remove/Limit Down Wood
California Mountain Kingsnake	Habitat Generalist	Habitat Generalist	Edge of Range, General Rarity, Collectors
Common Kingsnake	Habitat Generalist	Habitat Generalist	Edge of Range, General Rarity, Collectors
Northern Sagebrush Lizard	Open Brush Stands	Open Forests or Brush With Open Understory	Edge of Range, Fire Suppression

Trends

Rural, Agricultural and Residential Developments

- Without changes in water management policy and programs there will be a continued decline in habitat suitable of riparian-dependent vertebrate and invertebrate species. Programs that have been and are being developed to increase stream flows would have positive impacts on water quality and quantity but not enough so as to expect species to be found in all of their historic ranges.
- Continued influx of people and growth in rural residential housing will continue, increasing habitat fragmentation in wintering areas, home ranges and along dispersal and migration pathways. Impacts to species is specific and some species will benefit from an increase in human use.

Timber Harvesting:

- Clearcutting will continue on many of the private forest lands within the watershed. Without adequate riparian buffers, and limits on tractor logging and road construction. Riparian habitats are expected to continue to be fragmented and reduced in quality. Clear cuts will also increase habitat fragmentation and reduce connectivity for terrestrial species, particularly those of low mobility. Species that use edge and early seral stages (such as black-tailed deer) could be expected to be maintained in these areas.
- Partial Cutting will likely occur mostly on federal lands within the watershed as a response to forest health concerns and need to supply lumber for the economy. Planning to include spatial and temporal concerns for plant species and density diversity will maintain the quality of wildlife habitat for species.
- Salvage has been proposed for much of the watershed as a response to public interest. Salvage logging conducted on a broad scale must include consideration for spatial and temporal levels of snags, to prevent downward population trends for many species. Many of the special status species (Table 25) are snag-dependent and not considering their habitat needs may hasten the need to list them as threatened or endangered. Reduction of suitable snags may also affect the natural control of forest insects; many cavity dependent species are insectivorous.
- Pre-Commercial Thinning on private lands, in general, will likely continue to favor conifer growth and restrict growth of native hardwoods, decreasing stand diversity and suitability as wildlife habitat. In the last few years agencies have begun to include hardwood management in these young stands, thereby increasing species and structural stand diversity, which allows for a range of natural conditions and provides better quality wildlife habitat as an outcome.
- No harvesting on federal lands within the late successional reserves in the watershed may reduce increases in fragmentation in these reserves. As management techniques and timber harvest methods are developed, tested and monitored their future use in LSRs could contribute to the protection and maintenance of desired habitat conditions. In the short term, harvest and management restrictions in the LSRs may provide suitable habitat to protect species whose long term viability is in question. Maintenance of late-successional habitat in riparian reserves through restricted harvest and development of habitat in areas at risk areas may assist in

increasing connectivity between LSRs. In addition harvest restrictions in sub watersheds with 15% or less of their area in late successional forest may also allow for connectivity necessary for long term viability of these species.

There is a diversity of opinion, however, related to maintenance of late-successional habitat and riparian reserves. As the EHA points out, many of these areas are vulnerable to insects, disease and wildfires in their current condition (of being "overcrowded" due to past fire suppression). The trend of "no harvesting" in late-successional and riparian reserves is considered by many to be detrimental to maintaining ecosystem health.

Fire:

- Suppression activities can be expected to remain at current levels or increase as more of the watershed experiences population increases and the challenges of rural interface fire management. In addition there will not likely be a policy shift among state and federal agencies where human life, private property and resource values are at risk of loss from fire. The effects of this policy will continue as discussed in current conditions.
- Prescribed fire as a tool in resource management will likely continue to be of limited scale until federal and state agency policies and funding shift to accommodate this need. Current budget practices, air quality regulations and lack of public support in rural interface areas need to be addressed to change this trend. Limiting this tool will continue to affect habitat quality and quantity for those wildlife species whose habitat needs are consistent with habitat conditions frequented by low intensity fire.
- High Intensity fire will continue to be a possibility within the watershed as it is part of the natural cycle in southwest Oregon. However, due to past fire suppression, drought and increase in human population and recreation in the watershed, these fires have the potential to be more intense and affect more acres of forest habitat. Further loss of late-successional forest and riparian habitats would be detrimental to those species dependent upon them and increase the fragmentation of the remaining habitat.

Roads:

- Agency direction in the Northwest Forest Plan outlines the need for no net increase of roads on federal land within watersheds. In many areas of the watershed no net increase of roads will not alleviate negative impacts to wildlife that exist from current high road densities. Problems associated with disturbance, siltation of riparian areas and increase risk of human-caused fire will not be diminished unless overall number of miles of open roads is decreased throughout the watershed.

Grazing:

- Impacts to riparian vegetation, moist mountain meadows and low-mid elevation dry grasslands will continue to be detrimental to these wildlife habitats and their associated wildlife species. Changes to grazing practices on federal lands may promote some positive change in these habitats as range allotment plans are updated, but private land grazing methods are not as likely to change.

Bark Beetles and Woodborers:

- These species will continue to increase due to overcrowded stands resulting from fire suppression. As pointed out in the EHA, presence of these insects are a very important part of the ecosystem within the watershed. Not only do these species contribute to the ecosystem as a vital food source for other insectivorous species but as mechanisms of change within forest stands. Public and agency concerns over increased levels of activity of these invertebrates will likely lead to density management thinning to reduce their prevalence and impacts within the watershed. The impacts of broad scale thinning to wildlife species cannot be determined at this time as there is not sufficient data available.

Land Allocations:

- Implementation of the Northwest Forest Plan will allow for greater initial protection of late successional and riparian habitats. Short and long term implications of these allocations will be to increase the likelihood of population viability for many species. Species of high mobility are the ones most likely to benefit from late successional and riparian reserves. Land included within the AMA will likely experience many types of land management activities as the public, agency personnel and scientists experiment with new ideas. There may be positive and negative impacts to a range of wildlife species under these proposals and which can only be addressed by project type and location and with information provided by pre /post monitoring.

Public Use:

- Recreation will likely continue to increase as the population of the Rogue Valley and tourism increases. Species susceptible to harassment and disturbance (many species with young) from hikers, hunters and campers will continue to retreat to areas less accessible to humans. Increased recreation use will mean that less habitat will be available for use by these wildlife species. There may also be an increase in encounters with species such as the mountain lions as humans frequent areas within their home ranges on a more regular basis. Increase in off road vehicles use will continue a decline in quality habitat for many wildlife species, eliminating their occurrence from high off road vehicles use areas.
- Mining will likely continue at its current level. This use could continue to degrade the quality of riparian areas for wildlife species due to water diversions and increased sedimentation of streams. At this time, mining is limited to placer mining and a few hard rock mining operations. Mine adits provide suitable habitat for many bat species and so provide a positive benefit if the mining activity does not disturb maternity colonies or hibernacula. Closure of non-productive mine adits for public safety and health reasons may reduce bat habitat if surveys and protection measures are not included in these closures.
- Special Forest Products will likely increase in their importance from the watershed as they contribute to the local economy as residents shift to find non-timber related forest products. Much information is needed to understand the role of the species used as special forest products, sustainable levels of harvest and how their harvest may affect wildlife species. Species such as the Port-Orford cedar will likely continue to be at risk of disease until guidelines for bough removal and protection of non-infected stands are enforced. Loss of Port Orford cedar will diminish species diversity and structure in the riparian zones within the watershed and will negatively impact riparian zones.

Chapter VII - Desired Range of Future Conditions

The Aquatic Assessment team recognizes that the success of any desired future condition is very limited on private land, but critical to overall watershed health. Most of the DRFC statements reflect objectives on federal lands and are funding dependent. The following is a list of statements describe a Desired Range of Future Conditions that the Team has determined to be of importance:

Geologic DRFCs

- soil would be at its productive potential and handles precipitation without eroding the surface or resulting in cumulative effects off-site;
- compaction and displacement would be minimized on clay rich and wet soils;
- management activities would avoid reactivation of ancient landslides;
- monitoring would be done for past, current and future effects on soils for all types of activities;
- site-specific restoration projects would be developed for adversely impacted soils;
- priority would be given to project level work that inventories intermittent streams for rehabilitation opportunities;
- projects would be designed to maintain soil productivity;
- mitigation measures for soil impacting activities would be developed and monitored;
- adversely impacted lands would be restored;
- mine sites would produce minimal erosion;
- road surfaces and drainage structures would produce minimal erosion;
- unstable lands near riparian zones would produce minimal erosion;
- federally managed roads that are not needed would be obliterated;
- slope stability mapping and soil resources inventory updates would be done prior to any activities, and;
- instream diversions into agricultural ditches would be improved so the need to rebuild them every year is ended.

Terrestrial DRFCs

- projects influencing terrestrial wildlife habitats should consider the habitat needs for viable populations of all indigenous species and communities;
- late-successional habitat would be maintained or restored in sub-watersheds to provide for dispersal and migration of associated species. During analysis and implementation of activities within each sub-watershed consideration will be given to the sub-watersheds capability of providing late-successional habitat and where that habitat can be / should be located to accomplish wildlife needs. All sub watersheds do not have the same potential.

- oak woodland and ponderosa pine plant series should be restored to their pre-fire suppression condition. Stands should contain large diameter ponderosa pine and oaks with open grown characteristics;
- Douglas-fir and white fir plant series would be managed in a mosaic of relative densities, spatially and temporally, within sub-watersheds to provide habitat for wildlife species and community stability.
- white fir plant series should be managed at spatial and temporal scales. Areas that support true fir should be managed so as to provide for this habitat component within the watershed. As with the Douglas-fir series stand densities should be managed across the watershed to provide habitat for wildlife dependent on these "climax" plant communities;
- in all plant series that include hardwood species, the hardwoods should be actively managed. Hardwoods should be left at naturally occurring levels in all stands and their diameter and height growth should be encouraged as well as the conifers;
- snag management plans will provide for viable populations of cavity dependent species (Current models only account for the nesting needs of primary cavity excavating species).
- dry and wet meadows should be restored and maintained to support the structure and species composition of plants and animals that would have been present in the absence of intensive livestock grazing and with the inclusion of fire;
- miles of open roads within the watershed should be decreased in order to minimize disturbance to wildlife. Open road miles should include consideration for type of habitat and species use and requirements as well as considerations for other resources and fire suppression. In addition road miles per square mile and their location should be specific to the land allocation and the objectives of the allocation;
- native species (in all vegetation layers) would be dominant except in those portions of the watershed that are intensely used for agricultural, residential, or business activities;
- species and biotic communities at risk of extirpation would be recognized, and steps taken to promote their continued presence in the watershed;
- ecological processes important for diversity and ecosystem health would be encouraged;
- non-native plants and noxious weeds would not spread appreciably beyond their current distribution and would not appreciably increase in abundance on sites they already occupy. Purposeful introductions of non-native species or non-local stocks of native species would not occur on federal lands in the watershed. Private landowners would appreciate the value of native plant species and would have viable options for their use in seeding or planting projects;
- rangelands on federal land would be managed to maintain a good or better range ecological condition rating. Where range ecological condition is currently less than good, range trend would be upward;
- moist mountain meadows would have a plant and animal species composition similar to what was present before their long history of livestock grazing;
- low-mid elevation dry grasslands (and grass/shrub/tree mosaics, and savannah habitats) would occupy a percentage of the watershed as great or greater than now. Species composition would include the native species that would naturally be expected on these sites before their long history of livestock grazing and invasion by non-native plant species. Non-natives would be present but not increasing over time, and;

- valley bottom native plant and animal communities would occupy a somewhat greater percentage of the valley floor than they do now. Late seral stages of the communities would be scarce but present, and have some degree of connectivity along the riparian zone and with similar late seral plant communities away from the valley floor.

Stream and Riparian Zones

- riparian wildlife habitat should account for adequate dispersal and migration habitat for late-successional species and viable populations of species that are dependent on riparian zones for most of their life cycles;
- stream temperatures and water quality should be restored and maintained to allow for species such as the tailed frog and foothills yellow-legged frog to be found through out their historic ranges;
- large woody material should be retained in streams at a level that mimics natural processes in each plant series. This habitat should provide for levels of invertebrates to support riparian species that are dependent on them;
- recommendations that are made for restoration activities within riparian reserves should account not only for the aquatic conservation strategy but also the dispersal and migration functions of these reserves. Riparian reserves that are considered to be at high risk from loss of wildfire, insects or pathogens may be considered for restoration activities that would meet species and structural diversity and all the known values essential to riparian areas;
- culverts, roads and water diversions should be removed or altered, where possible, to allow for the natural functioning of streams. These structures should minimize their disruptive impacts to species migration and dispersal, and;
- healthy, clear streams with adequate shading, depth, and current to keep water temperatures below 65 degrees F.
- all conditions of the aquatic and riparian ecosystem would function and operate together to restore productivity, resiliency and diversity;
- hillslope, stream and riparian processes and functions would operate in a way to maintain biological productivity and diversity;
- stream and floodplain would be connected;
- riparian zones would be in mature hardwoods and conifers;
- riparian forests would be extensive enough to provide for the "climax" condition of the stream type, and;
- in a healthy condition streams and floodplains would be self-regulating.

Riparian vegetation on private land

Suggested riparian vegetation conditions on private land along the main stem of the Applegate River up to Applegate Dam, and on major tributaries below the dam would approach the following characteristics:

- functions well as habitat for the native aquatic and terrestrial organisms that live in and travel through it;
- has a high degree of connectivity of native riparian vegetation;
- landowners adhere to riparian vegetation guidelines provided in the Oregon Forest Practices Act and county ordinances;
- large diameter conifers would be more abundant. Important riparian hardwoods like black cottonwood, Oregon ash, and big-leaf maple would be more abundant and larger size classes of these trees would be present. Alders would continue to be abundant, but larger individuals would be more common, and alder stand density would be less, allowing colonization by other tree species;
- Blackberries would decrease in abundance and distribution. The rare native riparian vine *Smilax californica* (California greenbrier) would re-occupy some habitat where it is currently excluded by blackberries, and;
- Pool-riffle sequences would be appropriate for the expected range of the stream type. At least one pool every 4 to 9 bankfull widths in low-gradient channels (<3% slope, Rosgen 'C' channel). These channel types are generally depositional in nature and have pool/riffle sequences which are more predictable than steeper and confined channels. Currently pool frequency is low in alluvial valley channels and alluviated canyon channels.

Aquatic habitat would have these characteristics for salmonids:

- maximum water temperature of 65°F;
- nutrient levels - at background levels;
- large woody material would be at least 8 pieces of large wood per 1,000 lineal feet of stream(approximately 40/mi.), LWM is a minimum of 24 inches in diameter and 50 feet long or twice the bankfull width in length;
- riparian vegetation: 80% stream shading or maximum site potential;
- a mature conifer/hardwood riparian forest where appropriate with width adequate for floodplain and stream interaction and function, and;
- adequate streamflow for connection of aquatic habitats during all seasons.
- critical watersheds identified on the map will be restored to healthy habitat, and;
- specific restoration techniques will be utilized following recommendation in Chapter VIII.

Insect & Disease DRFCs

- Healthy, resilient conifer stands that will be able to absorb rather than magnify effects of native insects should be promoted. Such stands would be characterized by significantly lower stocking levels than currently occur in most stands on the Watershed. Though some clumps and dense stands should be maintained, especially in the white fir and hemlock series. A diversity of densities is desirable to provide suitable habitat for all wildlife species.

- Port-Orford cedar should remain in stands in the Applegate River Watershed. Impacts of Port-Orford cedar root disease should be minimized.

Chapter VIII - Recommendations

This chapter represents an integrated list of recommendations from team members. It is a comprehensive and integrated list of all recommendations which have been prioritized by the specialists and the full team. The most important of these recommendations will be carried forward to the executive summary (Chapter I) of this document.

Late-Successional Habitat

There may be opportunities to "speed up" development of stands with late succession characteristics in the Applegate AMA. These stand level prescriptions may differ from prescriptions to reduce insect and disease risk or reduce the risk of catastrophic fire (Goheen, draft 1994). The objectives is to propose a range of density management treatments that are specifically designed to develop species and structural diversity and larger diameter trees within the Applegate AMA.

It is most essential that stands identified for treatment be capable of producing late successional characteristics. Within the Applegate River Watershed most low elevations, south slopes, ridgetops, and shallow soils are high risk to develop and maintain late successional features. Higher elevations, north slopes, lower slope positions (including riparian zones) and deeper more productive soils are the lowest risk choices for the development of these features.

A. Geology

- minimize compaction on clay-rich and wet soils;
- avoid reactivation of ancient landslides;
- monitor for past, current and future effects on soils for all types of activities;
- develop site-specific restoration projects for adversely impacted soils;
- maintain soil productivity;
- develop and monitor new mitigation measures for activities;
- inventory intermittent streams for rehabilitation opportunities;
- restore mines and mining roads such that erosion is controlled or minimized;
- armor existing and planned road surfaces and drainage structures on sensitive soils and/or unstable lands;
- rehabilitate unstable lands near riparian zones;
- close federally managed roads that are not needed;
- update soils resources inventory and slope stability mapping prior to implementation of any project;
- design instream diversions into agricultural ditches that don't need to be rebuilt every year (gabions, jersey barriers, timber or concrete structures);
- consider all serpentine, limestone and granite lands as potential habitat for TE&S species, and;

B. Aquatic, Fisheries, Hydrology, and Riparian Vegetation

Riparian/Aquatic Habitat Complexity

Microhabitat and niches in the aquatic and riparian area should reflect the prehistoric conditions of the main river and tributaries.

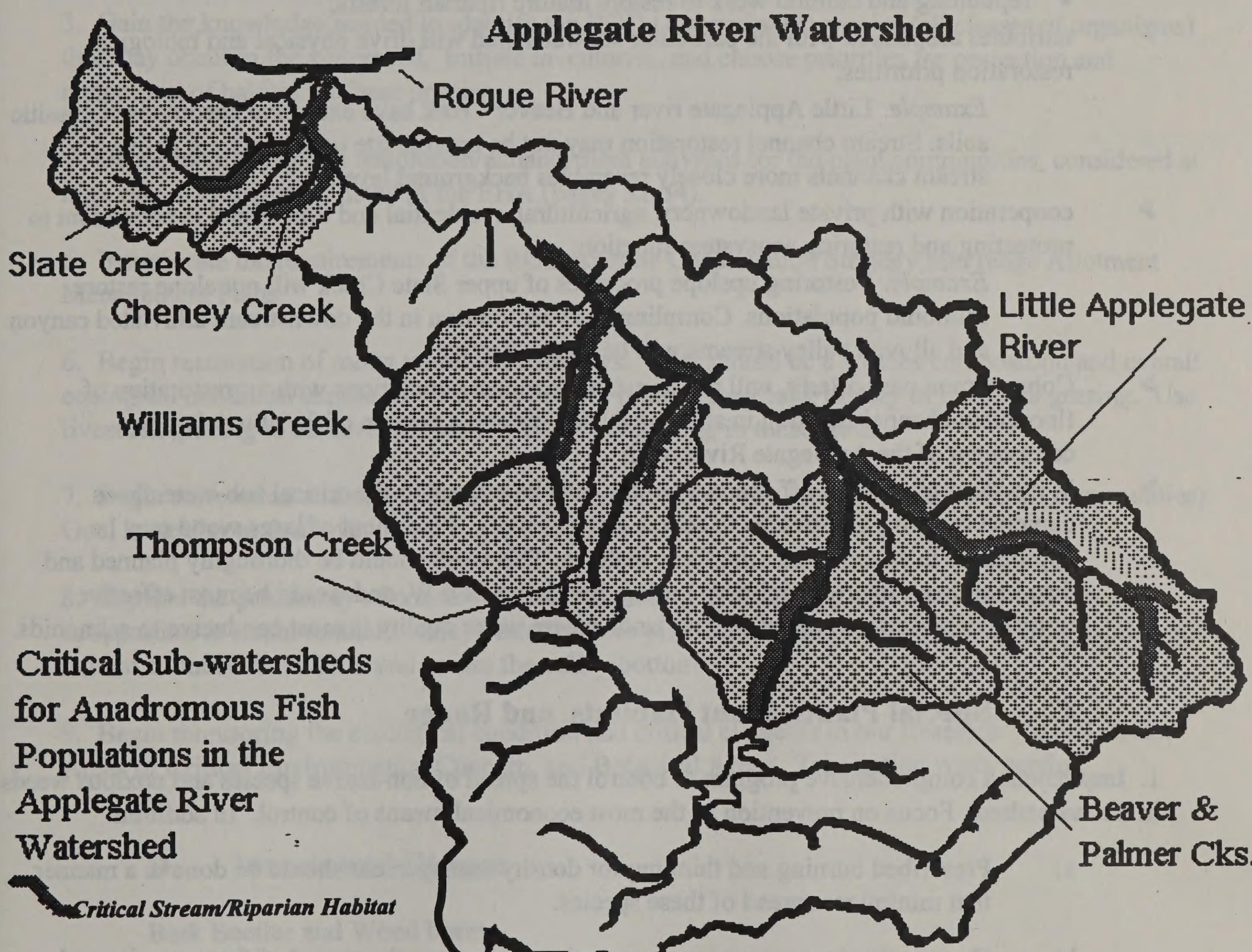
- increase the total number and type of microhabitats in streams, lakes, ponds and riparian zones;
- prioritize the protection and restoration of riparian/aquatic habitats by channel morphology segments;
- identify headwater tributaries in priority subwatersheds which are critical contributors of high quality water, wood, sediment, etc.;
- prioritize restoration in third order and larger streams that have confined valleys with terraces that currently are the only viable salmonid habitat;
- restore functions of alluvial valleys at and below confluences of streams within priority subwatersheds;
- evaluate headwater tributaries for sediment production, water contribution, riparian health, and etc.;
- determine fish presence in these streams and take appropriate restorative actions to secure favorable conditions;
- restore riparian conditions per ACS in third order and greater streams;
- restore alluvial valleys - per ACS, and;
- recommendation is for the Applegate AMA to be active in managing to achieve the goals of the Aquatic Conservation Strategy of the ROD.
- prioritize the protection and restoration of riparian/aquatic habitat by sub-watersheds. (President's Plan key watersheds Beaver, Palmer, Yale Creeks, and Little Applegate River) additional priority subwatersheds are Thompson, Williams, Cheney & Slate Creeks;

Sub-Watersheds (within the Applegate River Watershed) of concern

Figure 23 shows critical subwatersheds to the health of salmonids in the Applegate River watershed. These subwatersheds have been identified by a group of federal and State fisheries biologists.

These subwatersheds historically were large producers of salmonids and/or positioned to support a diverse assemblage of salmonids. Beaver Creek, Palmer Creek and Little Applegate River are designated as key watersheds under the Northwest Forest Plan for such reasons. Federal key watersheds are considered of great importance to the health of salmonid populations.

Figure 23. Critical Watersheds and High Priority Riparian Aquatic Habitats for Salmonids



Critical Watershed Stewardship:

Slate Creek, Cheney Creek and Williams Creek are important salmon producers.

- ➢ all these subwatersheds are of high value to salmonid production in the Applegate River;
- ➢ except for Beaver and Palmer Creeks all contain substantial private land in the alluvial valley segments;
- ➢ restoration of upslope, riparian and stream function is high priority:
  - this includes water conservation to restore streamflows during the dry season;
  - replanting and cultural work to restore mature riparian forests;
- ➢ attributes associated with the particular subwatershed will drive physical and biological restoration priorities;

  Example: Little Applegate river and Beaver Creek have extensive decomposed granitic soils. Stream channel restoration may not be appropriate until sediment delivery to stream channels more closely resembles background levels.
- ➢ cooperation with private landowners: agricultural, residential and timberland is paramount to protecting and restoring ecosystem function;

  Example: Restoring upslope processes of upper Slate Creek will not alone restore salmonid populations. Complimentary restoration in the downstream alluviated canyon and alluvial valley streams will be most effective.
- ➢ Coho salmon particularly, will not re-establish robust populations without restoration of floodplain/channel function in alluviated canyons and a portion of the alluvial valley component of the Applegate River, and:
- ➢ in the short term some off channel habitat may be created in the critical sub-watersheds depicted by allowing streams to access side channels. Placement of large wood may be appropriate in channels lacking these features. This work should be thoroughly planned and discussed in an inter-disciplinary setting, involving ODFW, and would be most effective immediately downstream of federal lands where water quality is most conducive to salmonids.

C. Special Plants, Plant Habitats, and Range

1. Implement a comprehensive program to control the spread of non-native species and noxious weeds in the watershed. Focus on prevention as the most economical means of control. In addition:

   a) Prescribed burning and thinning for density management should be done in a manner that minimizes spread of these species.

   b) On rangelands, use grazing systems that discourage the spread of these species and encourage native perennial grasses. In general this will mean a switch to more intensive herding, timing, rotation and rest systems, or removing livestock.

   c) Begin small scale restoration on wildlands where non-natives have taken over. Test burning, seeding, grazing, and other methods to find appropriate and economical methods. Then apply these methods on a larger scale.

Try direct eradication where new non-natives are entering the watershed or important areas for the first time, or where infestations are small and isolated.

2. Begin (or in a few cases, continue) monitoring populations of all species identified as having a high risk of extirpation (from Table 13). Begin changes in management, and restoration/enhancement projects for those high risk species that are likely to benefit from it. The species identified in the EHA (pgs. 33-36) are the highest priority for both monitoring and restoration activity.

3. Gain the knowledge needed to identify the ROD (Appendix J2) species (all classes of organisms) that may occur in the watershed. Initiate inventories, and choose priorities for protection and restoration of habitat for these species.

4. Begin monitoring and restoration/enhancement activities for the plant communities_ considered at high risk of extirpation, listed in the EHA (pages 32-34).

5. Incorporate the requirements of the ROD Aquatic Conservation Strategy into range Allotment Management Plans.

6. Begin restoration of moist mountain meadows. Goal should be a species composition and overall ecological condition similar to what was present prior to their long history of livestock grazing. Use livestock grazing to achieve this goal or eliminate grazing in these areas.

7. Begin restoration and maintenance of low-mid elevation dry grasslands (and related communities). Goal is similar to 5. above.

8. Explore the possibility of conservation easements/agreements and other private landowner cooperation to retain remnant valley bottom native plant communities, important riparian habitat, and habitat connectivity within and across the valley bottom.

9. Begin monitoring the ecological condition and critical elements in our Research Natural Areas, Areas of Critical Environmental Concern, and Botanical Areas. Take action when needed.

D. Insects and Disease

Bark Beetles and Wood borers

1) Decrease density in appropriate forest stands by thinning or judicious use of fire.
2) Seriously consider treatments in riparian stands as well as upslope stands and in stands in all allocations where retention of conifers (especially pines) is desired.
3) Aim to decrease basal areas to below 120 square feet per acre in upslope conifer stands and 140 square feet per acre in riparian stands in areas where reducing long term insect risk to pines is high priority. If possible, feature heavier stocking and clumps needed for some wildlife habitat in stand types that are least attractive to insects (first choice- stands with major hemlock, cedar, or true fir components, second choice- stands with

major Douglas-fir components.) Not all wildlife species can utilize islands of untouched late-successional "clumps", and may require larger habitat areas.

Port-Orford cedar

1) Special management efforts should be made to exclude *P. lateralis* from Port-Orford cedar stands in areas where the pathogen does not already occur; components of an exclusion program should include road closures, timing access to sensitive areas during dry weather, washing equipment that is being moved from infested to uninfested areas, developing Port-Orford cedar-free buffers along roads where introductions are likely to occur, and featuring Port-Orford cedars on sites unfavorable for the pathogen (upslope situations, convex slopes, well-drained microsites).

E. Wildlife

Based on analysis by sub-watershed on existing mature/late successional forest acres and patch size, minimize and avoid timber harvest that reduces the ability of the stand to function as suitable/dispersal habitat in subwatersheds identified as not meeting DRFCs for this habitat type.

- ➢ On appropriate sites, enhance structural diversity and increase growth rates in mature stands with silvicultural prescriptions designed to promote connectivity.
- ➢ Use low intensity fires to restore oak woodlands and pine sites to a more open condition and pre fire suppression species composition. Consider seeding of native grasses and forbs, brushing and planting of native tree species (sugar and ponderosa pine) where natural sources of seed may be minimal or non-existent.
- ➢ Acquire water rights or long term leases from private citizens to return surface water to streams, seeps, springs and ponds. In areas where livestock grazing occurs on federal lands fencing can be used to restore habitat quality. Enforcement of laws concerning illegal water diversions should be increased.
- ➢ Increase the quality of habitat in seeps, springs, and stream riparian areas and reintroduce native species where applicable. Areas where planting and thinning would increase species diversity and structure while maintaining existing habitat qualities should be identified and considered for restoration.
- ➢ Restore native species to moist mountain meadows and dry grasslands and incorporate the Aquatic Conservation Strategy into range allotment management planning. Where applicable, grazing and fire should be considered if it can help attain restoration objectives. Grazing and prescribed fire should be restricted in those areas where it will not allow for maintenance of native habitats. In some areas restoration activities should included seeding and planting of native species.
- ➢ Obliterate or decommission spur roads and natural surface roads. Where a high priority is placed on administrative access or recreational access surfacing of roads should be considered to minimized sedimentation. Road management should also consider opportunities for seasonal

and year round closures to minimize disturbance to wildlife while maintaining road surfaces for fire suppression access.

- Reforestation should insure a mix of tree species (conifer and hardwood) to mimic the natural range of conditions for the plant series type. Tree spacing at planting should consider all resource values, not just levels that maximize timber production. In some areas this may mean lower stocking levels to increase growth.
- Maintain a diversity tree species within the stand when thinning in sapling and pole stands. In areas where few hardwoods remain due to past management this may include thinning conifers out around individual hardwood trees to insure their continuation in the stand. In precommercial age stands thinning clumps of hardwoods to 2 or 3 stems per bole should be considered to maintain their health and vigor in the stand.
- Develop snag and down log recruitment and retention plans for proposed density management projects.

Chapter IX - Research and Monitoring

A. Information Needs

- current vegetation condition class information within riparian reserve areas and privately owned riparian zones for class 1-4 streams, for the entire watershed;
- range ecological condition and trend information for BLM and private lands;
- any information on introductions of non-local stocks of native plant species to wildlands in the watershed;
- the effects of restoration activities;
- distribution records of non-vascular plants and fungi listed in ROD (Appendix J2). Habitat information, keys, descriptions, of these species;
- effective methods to reduce the presence of non-native species in native plant communities, and;
- effects of stand density treatments (prescribed fire and thinning) on demographics of non-native plants.

Fisheries and Hydrology Information Needs

1. Continue present Oregon Department of Fish and Wildlife, BLM and Forest Service stream and riparian surveys to complete the entire watershed. Categorize the relative health and function of streams and floodplains in a format understandable by the federal and State agencies and public.
2. Refine the range of anadromous and resident salmonids data for the entire watershed, including where possible the range of non-salmonids e.g. sculpins, redside shiners, squawfish, dace, crayfish.
3. Classify the watershed's streams by geomorphic type e.g. bedrock or colluvial canyon, aluviated canyon, moderate slope-bound valley, alluvial valley. Further refine this large-scale classification of stream segments with a Level I Rosgen stream classification typing.
4. Set up an annual report format for issuing monitoring results from these activities and the ongoing activities listed below. Assemble a team of scientists, AMA participants and

specialists who are accountable for coordinating and reporting these efforts to other agencies and the public.

Wildlife Information Needs

1. Surveys and Inventories for special status species (vertebrate and invertebrate) to determine presence/absence, range within the watershed and habitat preferences within the watershed. To include common databases so all agency personnel have access to this information for planning purposes.

2. Surveys and Inventories for survey and manage species (vertebrate and invertebrate) to determine presence/absence, range within the watershed and habitat preferences within the watershed. To include common databases so all agency personnel have access to this information for planning purposes.

3. Integrated, ground verified, inventories on wildlife habitats and vegetation condition information throughout the watershed. These surveys should collect consistent data across federal and state lands and provide as much similar information as possible on private land habitats. This information needs to be available on GIS.

4. Riparian as well as stream surveys on streams within the watershed. Common data collected across ownership with common classification and prioritization methods. The information should be interdisciplinary for all resources to the extent possible.

5. Determine distribution and condition of snag and down log habitat throughout the watershed. Information obtained from surveys should be compared to the needs of snag and down log using species (as known) and incorporated into these activities.

6. Information for some species (vertebrate and invertebrate) to determine presence/absence, range within the watershed and habitat preferences within the watershed. To include a common database so all agency personnel have access to this information for planning purposes.

B. Current Research and Monitoring Activities

Fisheries and Hydrology

1. Several low gradient segments, generally unconfined flats in alluviated canyons on Federal lands, are surveyed intensively each 3 to 5 years, e.g. Steve Fork of Carberry Creek, Beaver Creek. These Forest Service Level III riparian surveys monitor changes in microhabitat, salmonid abundance, streambed material changes, streambank changes and geomorphic channel changes.

2. Temperature monitoring has been ongoing for three years (1992-1994) in several sub-watersheds: Little Applegate River, Beaver Creek, Elliott Creek, Middle Fork Applegate River, Steve Fork, etc.. The Forest Service, BLM and ODFW cooperate on field work and reporting this information. Increase the number of sites for temperature monitoring to assess stream habitat conditions on private lands where possible.

3. All stream segments containing salmonid fish populations on National Forest lands should be surveyed using the standard Level II riparian stream survey protocol within the next ten years.

4. Water quality testing and monitoring is ongoing in some lakes in the Red Buttes Wilderness and some streams in the Applegate River watershed on federal lands.

Other Research and Monitoring Projects, Status and Type

Table 27. **Research and Monitoring Project List** (as of May 1995)

Study Title	Contact	Project Status	ECO/ Social Class	Project Class
Climate Stations	Stienfeld	5	AC	I
Airborne Environmental Analysis	Chen	2	AQ	E
Special Forest Products Inventory on Private Lands	Amaranthus	4	SC	E
Special Forest Products Inventory on Federal Lands	Amaranthus	3	SC	E
Applegate Partnership as Model of Collaboration	Sturtevant	4	SP	
Terrestrial Inventory	Amaranthus	1	T	I
T&E Assessment	Amaranthus	1	T	I
Harvest Schedule Model	Warner	1	T	E
Remote Sensing (Landsat) Accuracy Assessment	Reilly	1	T, TP	I, E
Little Applegate Uplands & McDonald Basin Restoration	Vance	1	T,WQ	E, R
Amphibian Locations	Arnold		TA	I
Siskiyou Mountain Salamander	Mamone		TA	I
Spotted Owl Use of Douglas-Fir Dwarf Mistletoe	Marshall	1	TB	R, E
Neotropical Bird Monitoring	Janes	5	TB	I, E
Spotted Owl Movement/Nesting/Reproduction	Arnold	4	TB	I, E
Marbled Murrelet Nesting	Finley		TB	I
Bird Population Monitoring in Managed Sites	Trail	1	TB	
Band-tailed Pigeon Population Monitoring	Trail	1	TB	
Bird Survey of Ponderosa Pine Communities	Trail	1	TB	
Goshawk Survey	Mamone	4	TB	
Spotted Owl Survey	Mamone	4	TB	I

Table 27. Research and Monitoring Project List (continued) Study Title	Contact	Project Status	ECO/ Social Class	Project Class
Avian Monitoring - Mist Netting Applegate Lake	Mamone	4	TB	I
Avian Point Count Surveys	Mamone	2	TB	R
Fire Histories of Plant Associations	Main	1	TF	
Native Bunchgrass Enhancement With Fire	Martinez	1	TF	E
Fuels Hazard Analysis Using Landsat & Veg Mapping	Partridge	1	TF	I, E
Fuels Inventory Photo Series	Yokum	4	TF	I
Prescribed Fire/Native Plants/Fuels	Rolle	5	TF, TV	E
Bat Calls Recording w/SOSC	Mamone	2	TM	R
Bat Populations	Broyles	4	TM	I
Deer Winter Range	Godwin		TM	I
Range Analysis Surveys	Williams		TM	I
Soil Disturbance and Compaction	Amaranthus	4	TP	E, R
Landscape Soils and Erosion Hazard Inventory	Steinfeld	1	TP	I, E
Harvest Systems - Small Diameter Trees	Brock	1	TP	E
Soil Disturbance	Steinfeld	5	TP	
Soil Arthropods, Carbon Cycling	Moldenke	4	TS	E, R
Density Management/Bark Beetles - Thompson Creek	Russell	1	TT	E, R
Maintenance & Enhancement Large Diameter Conifer	Main	5	TT	
Stocking Control Around Pines - Federal Lands	Marshall	3	TT	E, R
Estimating Vigor of Mature Conifers	Main	1	TT	
Density Management/Bark Beetle - Squaw/Elliott	Miller	1	TT	
Effects of Salvage: Wildfire & Wildlife	Amaranthus	1	TT	E, R
Density Management/Bark Beetles - Waters Creek	Link	1	TT	
Dendrochronological Study	LaLande	1	TT	E
Tree Planting, Stocking and Survival	Schober	5	TT	I, E
Old Growth Developmental Pathway	Sensenig	3	TT	R
Changing Forest Structure from 1938-1992	Amaranthus	1	TT	E, R
Ecology Plot Inventory	Atzet	4	TV	I, E
Medusahead Control	Brock	1	TV	E
Lady Slipper Ecology and Management	Brock	1	TV	E
Investigate Elimination of Star Thistle	Mumblo	1	TV	E
Fossil Pollen Study	LaLande	1	TV	E
Lichen Survey	Severs	4	TV	E, R
Timing of Broadcast Burns on Flora	Brock	1	TV, TF	E
Stream Segment Monitoring - Level III USFS Survey	Maiyo	4	W	I
Rosgen Stream Classification and Monitoring	Maiyo	4	W	I
Lake Surveys	Brazier	4	W	I
Aquatic Inventory		1	WA	I
Aquatic Insect Survey	Bessy	4	WA	I
One Pass Electrofishing	Bessy	4	WA	I
Macroinvertebrate Surveys	Maiyo	4	WA	I
Fish Census Sampling	Maiyo	4	WA	
Spawning Surveys		4	WA	I
Water Temperature and Flow Monitoring	Zan	5	WQ	I
Stream Shade	Zan	4	WQ	I
Water Temperature & Flow Monitoring	Brazier	4	WQ	I

Table 27. **Research and Monitoring Project List** (continued) **Study Title**	**Contact**	**Project Status**	**ECO/ Social Class**	**Project Class**
Riparian Restoration 95	Marshall	2	WV	M
Riparian Restoration 96	Marshall	1	WV	M
Stream Habitat Survey (ODFW Method)		4	WV	I
Stream habitat Survey (USFS Level II)	Maiyo	4	WV	I

Legend/Codes

Project Status

1 Proposal
2 Funded
3 Study Plan Completed
4 Project Implementation In Progress
5 Interim Report
6 Final Report

Eco/Social Class

Air: AF - Fire, AC - Climate, AQ - Quality
Water: WA - Animals in riparian, WV - Riparian vegetation, WQ - Water quality and quantity

Terrestrial: TA - Terrestrial amphibians, TV - Terrestrial vegetation, TP - Terrestrial productivity, TM - Mammals, TF - Terrestrial Fire, TB - Terrestrial Birds, TS - Terrestrial soil, TT - Terrestrial trees

Social: SE - Education, SP - Public participation, SN - Native American, SC - Commodities

Project Class

Detection (inventory)	I
Evaluation	E
Research	R

Chapter X - References

A Federal Agency Guide for Pilot Watershed Analysis (Jan 1994).

Agee, K.J. 1993. Fire ecology of the Pacific Northwest Forest. Island Press, Washington, D.C. 493 pp.

Amaranthus, M.P., R.M. Rice, N.R. Barr, and R.R.Ziemer. 1985. Logging and Forest Roads Related to Increased Debris Slides. J. Forestry 83:229-233.

Applegate Watershed Assessment (11/94) prepared for the State of Oregon Watershed Health Program and the Strategic Water Management Group (SWMG).

Applegate AMA Ecosystem Health Assessment (1994)

Atzet, T. and D. Wheeler. 1982. Historical and Ecological Perspectives on Fire Activity in the Klamath Geologic Province of the Rogue River and Siskiyou National Forest.

Austin, K. 1993. Habitat Use and Home Range Size of Breeding Northern Goshawks in Southern Cascades.

Axelrod, D.I. 1967. History of the Coniferous Forests, California and Nevada. University of California. Botany 70:1-62.

Barrett, J.W. 1979. Silviculture of Ponderosa Pine in the Pacific Northwest: the State of Our Knowledge. Gen. Tech. Report PNW-97. Portland, OR. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. 106 p.

Beaver and Palmer Creek Watersheds (1994) Rogue River National Forest, Applegate Ranger District. A Watershed Analysis covering approximately 24,095 acres.

Bradley, Gordon A. (ed.) 1984. Land Use and forest Resources in a Changing Environment: The Urban/Forest Interface. Seattle: University of Washington Press.

Detling, L.E. 1961. The Chaparral Formation of Southwest Oregon, with Considerations of its Postglacial History. Ecology:348-357.

Eastside Forests Scientific Panel. 1994. Interim Protection for Late-Successional Forests, Fisheries, and Watersheds. National Forests east of the Cascade Crest, Oregon and Washington. A report to the United States Congress and the President.

Forest Ecosystem Management Assessment Team (FEMAT), entitled Forest Ecosystem Management: An Ecological, Economic, and Social Assessment in July of 1993.

Franklin, J.F. and R.T.T. Forman. 1987. Creating Landscape Patterns by Forest Cutting: Ecological Consequences and Principles. Landscape Ecology 1:5-18.

Frissell, Christopher A., Liss, William J., Warren, Charles E., Hurley, Michael D., A Heirarchical Framework for Stream Habitat Classification: Viewing Streams in a Watershed Context, Oak Creek Laboratory of Biology, Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331.

Furniss, R. J. and Carolin, V.M. 1977. Western Forest Insects. USDA Forest Service. Miscellaneous Publication No. 1339. 645p.

Gara, R.I., D.R. Geiszler and W.R. Littke. 1984. Primary Attraction of the Mountain Pine Beetle to Lodgepole Pine in Oregon. Annals of the Entomological Society of America 77:333-334.

Hansen, P.M., Goheen, D.J., Hessburg, P.F., Schowalter, T.D. 1988. Biology and Management of Black Stain Root Disease in Douglas-fir. IN Harrington, T.C. and Cobb, F.W/ Jr., eds. Leptographium Root Diseases on Conifers. American Phytopathological Society Press, St. Paul, Minnesota. 149 pp.

Haskell, B.D., B.G. Norton, and R. Costanza. 1994. What Is Ecosystem Health And Why Should We Worry About It? p 3-20 in R. Costanza, B.G. Norton, and B.D. Haskell (eds.). Ecosystem Health. Island Press, Washington, D.C.

Jones, J.A. and G.E. Grant. Peak Flow Responses to Clearcutting and Roads, Western Cascades, Oregon: I. Small basins. (submitted).

Jones, J.A. and G.E. Grant. Peak Flow Responses to Clearcutting and Roads, Western Cascades, Oregon: II. Large basins. (submitted).

Karr, J. 1991. Biological Integrity, a Long-Neglected Aspect of Water Resource Management. Ecol. Appl. 1:1.

Kolb, T.E., M.R. Wagner and W.W. Covington. 1994. Concepts of Forest Health. J. of Forestry 92(7):10-15.

Leiberg, J.B. 1900. The Cascade Range and Ashland Forest Reserves, and adjacent Regions, U.S. Geological Survey, Department of Interior, Government Printing and Office, Washington, D.C.

Merritt, R.W., and Cummins, K.W. 1984. An Introduction to the Aquatic Insects of North America. Kendall/Hunt Publishing Co., Dubuque, Iowa. 722p.

Moffatt, R.L., R.E. Wellman, & J.M. Gordon 1990 Statistical Summaries of Streamflow Data in Oregon: Volume 1--Monthly and Annual Streamflow and Flow-Duration Values. U.S. Geological Survey Open-File Report 90-118. Portland, OR.

Morrison, P.H. and S.J. Swanson. 1990. Fire History and Pattern in a Cascade Range Landscape. U.S.D.A. Forest Service. PNW-GTR-254. 68pp.

Nehlsen, W., Williams, J.E., and Lichatowich, J.A., 1991. Pacific Salmon at the Crossroads: Stocks at risk from California, Oregon, Idaho, and Washington. Fisheries 16:4-21.

O'Laughlin, J., J.G. MacCraken and D.L. Adams. 1993. Forest Health Conditions in Idaho. University of Idaho, Wildlife and Range Sci. Rep. #11.

Oregon Employment Division. 1992. Busines and Employment Outlook, Volume 1 for Jackson and Josephine Counties, Economic Structure and Analysis. Salem, Oregon: Oregon Employment Division.

Oregon Employment Division. 1993. The Oregon In-Migration Survey. Salem, Oregon: Oregon Employment Division.

Perry, D.A. 1988. Landscape Patterns and Forest Pests. Northwest Environ. J. 4: 213-288.

Planning and Monitoring Section, Water Quality Division, Oregon Department of Environmental Quality. August, 1988. Oregon Statewide Assessment of Nonpoint Sources of Water Pollution, Portland, OR.

Preister, Kevin. 1994a. Words Into Action: A Community Assessment of the Applegate Valley. Ashland, Oregon: The Rogue Institute for Ecology and Economy. Prepared in cooperation with the Applegate Partnership. May.

Preister, Kevin. 1994b. "Social and Economic Monitoring in the Applegate Valley," Unpublished paper. Ashland, Oregon: The Rogue Institute for Ecology and Economy, May.

Rapport, D.J. 1989. What constitutes ecosystem health? Perspectives in Biology and Medicine 33: 120-132.

Record of Decision, Northwest Forest Plan. 1994.

Reeves, G.H., Everest, F.H., Hall, J.D. 1987. Interactions between the redside shiner (Richardsonius balteatus) and the steelhead trout (Salmo gairdneri) in western Oregon: the influence of water temperature. Canadian Journal of Fisheries and Agriculture. Sci. 44:2603-1613.

Rivers, C.M. 1963. Rogue River Fisheries. Volume 1. History and development of the Rogue River Basin as related to its fishery prior to 1941. Oregon Department of Fish and Wildlife. November, 1991.

Rogue Basin Fish Management Plan (DRAFT 10/94) prepared by the Oregon Department of Fish and Wildlife (ODFW) and a Public Advisory Committee

Rosgen, D.L. 1993. Applied Alluvial Morphology. Lecture Reference Document. Wildland Hydrology Consultants, Pagosa Springs, Colorado.

Sampson, R.N., D.L. Adams and S. Hamilton. 1994. Assessing forest health in the inland Northwest. Am. For. 100:13-16.

Sturtevant, Victoria 1989. "A Survey of Residents of the Interface." Paper presented at workshop: "The Interface: Forest Management in Socially-Sensitive Areas." Sponsored by the Society of American Foresters, Siskiyou Chapter and School of Social Science, Southern Oregon State College, Ashland, Oregon, October 27.

The 1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution, Planning and Monitoring Section, Water Quality Division, Oregon Department of Environmental Quality, Portland, OR. August 1988.

Whittaker, R.H. 1960. Vegetation of the Siskiyou Mountains, Oregon and California. Ecological Monographs 30:279-338.

Whittaker, R.H. 1961. Vegetation history of the Pacific coast states and the "central" significance of the Klamath Region. Madrono 16:5-23.

Zobel, D.B., Roth, L.F., and Hawk, G.M. 1985. Ecology, Pathology, and Management of Port-Orford cedar (*Chamaecyparis lawsoniana*). USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. General Technical Report PNW-184. 161p.

Chapter XI - Appendix

SOIL PROCESSES

Soil biology, chemistry and physics act both independently and collectively to create soil characteristics that determine "Soil Productivity". Productivity is the ability of a soil to yield vegetation (crops).

Before talking about the activities which affect soil biology, chemistry and physics (mechanics) we need to first identify their characteristics and relationship, remembering each is a study within itself.

Soil biology is the study of the populations of both plant and animal within the soil. They use the existing organic matter as energy and tissue building material. The populations are sensitive to temperatures, aeration (both aerobic and anaerobic conditions), and moisture conditions (saturation etc.). They are the primary factors in nutrient cycling and organic (humus) development.

Soil chemistry is generally related to the fertility characteristics of the site. It is dependent on the parent material of the soil, the clay content, the humus content, vegetative regime etc. These give the soil its ability to supply and hold the nutrients. Other chemical soil characteristics relate to the soils ability to tie-up nutrients thus making them unavailable to plants.

The soil physical characteristics important to soil productivity are the structure, texture, mineralogy, etc. Soil structure is altered by mechanical forces and organic characteristics and affects the infiltration rates, permeability, aeration, etc. which directly affect productivity. Texture relates to soil infiltration and permeability rates which determine aeration and water holding capacities. It also relates to nutrient holding capacity for the fertility levels.

The surface soil (topsoil) is where most of the biological and chemical activity occurs. It is the major zone of root development, carries most of the nutrients for plant use and supplies a large portion of the water used by plants. It is easily altered by management activities yet is extremely important if soil productivity is to be maintained. Research has shown that as much as 80 to 90 percent of soil productivity can be attributed to the topsoil.

The productivity of a soil is also greatly influenced by the nature of its subsoil. The subsoil is much less active and provides less of the nutrients and water to plants than the surface soil; however it is the zone that tides plants over during times of stress. If its permeability or structure is altered it could affect the rooting capability of the plants through lack of aeration and increased resistance (strength of soil) to rooting. This sometimes changes the suitability of the existing vegetation through stress and die-off.

Management activities affect the soils productivity characteristics. Below are observations based on the experiences of soil scientists working in this area and informal monitoring in and around this study area. Effects of the impacts are taken from research conducted in the Pacific NW and SW.

Tractor logging has created compacted soils over considerable areas in the watershed, concentrated on areas used for skidding. Monitoring has shown that roads, landings and secondary skid roads exceed Regional standards and guidelines for percent of increase in bulk density for the soils measured. Communication with FIR indicates that adequate skidding could be done if 3 percent of the area was dedicated to skid trails.

Machine piling with tractors has been used for reducing slash, removing competing vegetation and/or creating planting spots. This activity has generally been done without consideration of its cumulative effect on the area. Machine piling with tractors creates additional compaction and also removes surface soil (topsoil) and places it in the piles. Generally piling creates the same compaction effect as are found on primary and secondary skid trails. The biggest variability is the percent of area piled and the amount of material piled. Piles commonly occupy 10 to 20 percent of the area and scarified areas make up 80 to 90 percent of the piled areas. The combination of compaction and surface soil removal is very severe to a soil's productivity capacity.

Windrowing is the systematic piling of brush in rows and is very similar to machine piling but generally covers 100 percent of the area. Little windrowing has occurred in this area. Soil compaction and surface soil removal were the detrimental effects. Interwindrows occur on about 80 percent of the area and the windrows occupy 20 percent. The compaction is often comparable to a primary skid road.

Windrowing has created compacted skid roads and landings whereas machine piling often masked the compacted skid roads and itself compacted the land especially around the bunch piles of slash. The machine piling also removed various amounts of topsoil and placed it in piles. Wherever these activities occurred, monitoring is needed to determine the actual degree of compaction and soil removal and over what percent of the area. We have research that relates to loss of productivity due to topsoil loss and compaction.

High-lead yarding has had the most detrimental effect on the soils of all the cable yarding systems. It does not suspend the logs; rather it drags them from the unit to the landing. The area affected has a cone shape pattern. This allows soil gouging whenever the log is dug into the soil and near the landing 100 percent of the soil surface is scalped. Gouging, which is the scalping of the surface soil within the unit, could have various effects depending on the localized topography and soil characteristics. Effects of gouging on productivity and potential for erosion that reaches drainages needs analysis. The percent of surface soil loss near landings needs to be assessed because it depends on the units shape, number of yarder settings, etc. Gouging reduces soil productivity.

Skyline yarding has various forms. Generally the yarding is not detrimental to soil productivity except in isolated pockets where the logs did not have suspension and created trenches up and down the slope.

Compaction takes on many different forms and needs to be assessed based on the individual soil's potential and resiliency.

In general, compaction effects the soil biology by reducing the macropore space, thus changing the air and water relationships within the soil. Soil displacement and removal effects the soil biology by removing the source for food and altering the air and water relationships.

In general, compaction effects the soil chemistry by changing the water movement within the soil and can result in anaerobic conditions which create a different chemical reaction. Soil removal or displacement changes the soil chemistry by removal of the highest nutrient (elements) source and the material that hold the nutrients in place. It changes the water holding capacity.

Compaction alters the soil physical characteristics by changing the structure to massive or breaks down the structure which in turn slows the exchange of air and water into and within the soil. Displacement or removal generally alters the soil physical conditions by destruction of the structure.

The following general observations were made in the assessment area and should be taken into consideration in project designs:

- south exposures or aspects are very slow to recover from burning or any other management practices;
- soils erode easily if exposed;
- woody material of all sizes is critical for maintaining surface stability;
- gully erosion has occurred where runoff has concentrated in channels;
- soil organic matter is slow to accumulate, and;
- there is a need to start long-term soil restoration to repair damage done by previous management practices.

Monitoring by others have shown indications of:

Hot burning has reduced organic matter by 90% and total nitrogen by 80%.

Reforestation is inhibited on soils with coarse fragments; studies show:

- soils with 35 to 70% coarse fragments had 24% seedling survival.
- soils with 70 to 100% coarse fragments had 16% survival.

The impacts on soil productivity of all past management activities need to be assessed prior to new management activities on the particular soil-site. Rehabilitation or restoration measures are extremely slow and rarely restore a site to full potential. Impacts are long term or permanent so alternatives or mitigation measures need to be discussed and planned for all management activities. In addition, the cumulative effects on the soils need to be addressed. Such things as the effect of multiple past entries and the relationship of runoff from roads and from burning or how they interact to create erosion in the depositional soils and positions.

SEISMIC RISKS

- The Applegate Watershed has had little recent historic earthquake activity. None the less the potential for damage to man-made structures (pen stocks, buildings, reservoirs, etc.) and triggering landslides on unstable slopes is present from several sources.

- The High Cascade volcanoes are still active. Movement of liquid rock rising from depths to the surface can cause earthquakes, even when this material does not reach the surface. This has happened in the surrounding area several time in the last couple of decades (Mt. Shasta and Medicine Lakes Highlands).

- Klamath Falls recently had an earthquake. This was caused by a process that geologists refer to as back-arc-spreading. As a result of this the land behind a volcanic arc (the High Cascades or Japan as examples) often develops a spreading center.

- As the land behind the High Cascades spreads and stretches it moves the Cascades westward relative to the rest of the continent. The Western Cascades were formed in Eastern Oregon, Japan was once attached to the Asian mainland but by the same process ripped free and moved out to sea.

- The Oregon Department of Geology and Mineral Industries has confirmed that Eastern Oregon has "stretched," moving the Rogue River National Forest westward 340 kilometers (211 miles) during the previous 20 million years. This action is continuing today, resulting in the high probability that Klamath Falls type earthquakes will occur again.

- Parallel to and near the Oregon Coast there is both a spreading center and a subduction zone. Large earthquakes are associated with both of these types of features.

- In the fall of 1994 a strike-slip fault associated with this spreading center generated an earthquake of 6.8 magnitude. In this quake land masses slid sideways past one another and occurred 130 miles out to sea.

- Whereas, in a subduction generated earthquake the ocean plate slides under the continental plate, much closer to, or under the landmass of the Pacific Northwest. This would generate a significantly larger quake and changes to the land surface.

- Beneath the Pacific Northwest The Pacific Plate is sliding in a sub-horizontal direction as it descends toward the base of the High Cascades. A subduction generated earthquake could occur anywhere along this plane whose extent covers all the land west of the Cascades and from northern California to Canada. However, under the Applegate Watershed the plate is kinked and forced to descend at a much steeper angle. This bend is considered responsible for the seven kilometer uplift of the Condrey Mountain Dome.

- Recent studies of tsunami deposits ("tidal waves") have shown that approximately every 350 to 550 years the subduction zone off of the Pacific Northwest Coast generates an earthquake 100 times more powerful than the 6.8 magnitude quake we recently felt. Magnitude is measured on a logarithmic scale, so this future quake would be an 8.8 or larger. In modern history there has never been an earthquake this large. The last great quake of the Oregon Coast occurred between 1690 and 1710 (possibly as a series of great quakes) and predictions are that it will occur within the next 50 to 250 years.

- Serpentine almost always contains some asbestos.

- The possibility of finding commercial minerals like gold, mercury and chrome exists on the Applegate River Watershed.

SEISMIC RISKS OF SOUTHERN OREGON

- Southern Oregon has had little recent historic earthquake activity. None-the less the potential for damage to made-made structures, triggering landslides on unstable slopes and tsunamis ("tidal waves") on the coast is present from several sources.
- In 1993 Klamath Falls had a moderately large earthquake of about 6.0 magnitude. This was caused by extentional faulting in the basin and range. As the land behind a volcanic arc spreads and stretches it is moving the Cascades westward relative to the rest of the continent. This stretching caused the recent Klamath Falls earthquake.
- The Oregon Department of Geology and Mineral Industries has confirmed that Eastern Oregon has "stretched", moving the Watershed westward 340 kilometers (211 miles) during the previous 20 million years. This action is continuing today, resulting in the high probability that earthquakes, like the one in Klamath Falls, will occur again.
- Parallel to, and near the Oregon coast, there is both a spreading center and a subduction zone. Associated with the spreading center are transform faults called the Mendocino and Blanco Fracture Zones. Large-to-extremely large earthquakes are associated with these features.

In the fall of 1994 a strike-slip fault associated with this spreading center generated an earthquake of 6.8 magnitude. In this quake ocean plates slid sideways past one another and occurred 130 miles out to sea. Energy released was about 30 times that of the Klamath Falls Earthquake.

In a subduction zone generated earthquake the ocean plate slides under the continent, much closer to, or under the Pacific Northwest, generating a significantly larger earthquake.

Beneath the Pacific Northwest the Pacific Plate is sliding in a sub-horizontal direction as it descends toward the base of the High Cascades. A subduction generated earthquake could occur anywhere along the interface between the subducting plate and the continent. That would be anywhere along the coast from northern California to Canada.

Recent studies have shown that approximately every 350-to-550 years the subduction zone near the Pacific Northwest coast generates a 9.0 magnitude earthquake, with possibly 27,000 times more energy released than the Klamath Falls earthquake.

A 9.0 magnitude quake would shake continuously for 3-to-5 minutes. A quake of this size would not have a single center of shaking, rather the entire Pacific Northwest coast may move at once. This may be the largest earthquake ever recorded. The last great quake of the Oregon Coast occurred around 1700 and predictions are that another will occur within the next several hundred years.

Chapter XII - Acronyms

Table 28. **List of Acronyms** (revised from the Ecosystem Health Assessment)

ACEC	Area of Critical Environmental Concern
ACOE	Army Corps of Engineers
AMA	Adaptive Management Area
AMS	Analysis of the Management Situation
ARD	Automated Resource Data
ARPA	Archeological Resources Protection Act
AUM	Animal Unit Month
BLM	Bureau of Land Management
BMP	Best Management Practices
BRU	Basic Resource Unit
CEQ	Council on Environmental Quality
CFI	Continuous Forest Inventory
CFR	Code of Federal Regulations
CMAI	Culmination of Mean Annual Increment
CRMP	Coordinated Resource Management Plan
CSU	Controlled Surface Use
CWD	Coarse Woody Debris
DBH	Diameter at Breast Height
DCA	Designated Conservation Area
DEQ	Oregon Department of Environmental Quality
EA	Environmental Assessment
ECA	Equivalent Clearcut Area
EEA	Environmental Education Area
EHA	Ecosystem Health Assessment (Applegate AMA)
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESC	Existing Stand Condition
FEIS	Final Environmental Impact Statement
FEMAT	Forest Ecosystem Management Assessment Team
FIR	Forest Intensified Research
FLPMA	Federal Land Policy and Management Act
GFMA	General Forest Management Area
GIS	Geographic Information System
HCA	Habitat Conservation Area
HIM	High Intensity Management
IFMP	Intensive Forest Management Practices
ISA	Instant Study Area
LCDC	Land Conservation and Development Commission
LIM	Low Intensity Management
LUA	Land Use Allocation
LWM	Large Woody Material
LSR	Late-Successional Reserve
MFP	Management Framework Plan
MMBF	Million Board Feet

MMCF	Million Cubic Feet
MPA	Managed Pair Area
MTP	Master Title Plats
N/A	Not Applicable
NA	No Action
NEPA	National Environmental Policy Act
NPV	No Present Value
NSO	Northern Spotted Owl
NSO	No Surface Occupancy
NWSRS	National Wild and Scenic Rivers System
O&C	Oregon and California (revested lands)
ODFW	Oregon Department of Fish and Wildlife
OGEA	Old Growth Emphasis Area
OHV	Off-Highway Vehicle
OI	Operations Inventory
ONA	Outstanding Natural Area
ORV	Outstandingly Remarkable Value
OWRD	Oregon Water Resources Department
OSHA	Occupational Safety and Health Administration
OSMP	Oregon Smoke Management Plan
OSO	Oregon State Office
PA	Preferred Alternative
PCT	Pacific Crest Trail
PCT	Precommercial Thinning
PD	Public Domain
PILT	Payment in Lieu of Taxes
PM	Particulate Matter
PNV	Present Net Value
PP&L	Pacific Power and Light
PRMP	Proposed Resource Management Plan
PSC	Power Site Classification
PSQ	Probable Sale Quantity
QMA	Quality Management Area
R&PP	Recreation and Public Purposes
R&R	Restoration and Retention
RA	Resource Area
RAMP	Recreation Area Management Plan
RHA	Residual Habitat Area
RIA	Rural Interface Area
RMA	Riparian Management Areas
RMP	Resource Management Plan
RNA	Research Natural Area
ROD	Record of Decision (Northwest Forest Plan)
RPS	Rangeland Program Summary
SCFL	Suitable Commercial Forestland
SIP	State Implementation Plan
SOMA	Spotted Owl Management Area
SRI	Soil Resource Inventory
SRMA	Special Recreation Management Areas
SYU	Sustained Yield Units

T&E	Threatened and Endangered
TPCC	Timber Production Capability Classification
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USF&WS	U.S. Fish and Wildlife Service
VRM	Visual Resource Management
W&SR	Wild and Scenic River
WODDB	Western Oregon Digital Database
WSA	Wilderness Study Area

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Medford District Office
3040 Biddle Road
Medford, Oregon 97504

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

FORWARDING AND ADDRESS
CORRECTION REQUESTED